~~DISPLAY~~ - ROUTE

T TRANSFORM

Page 118

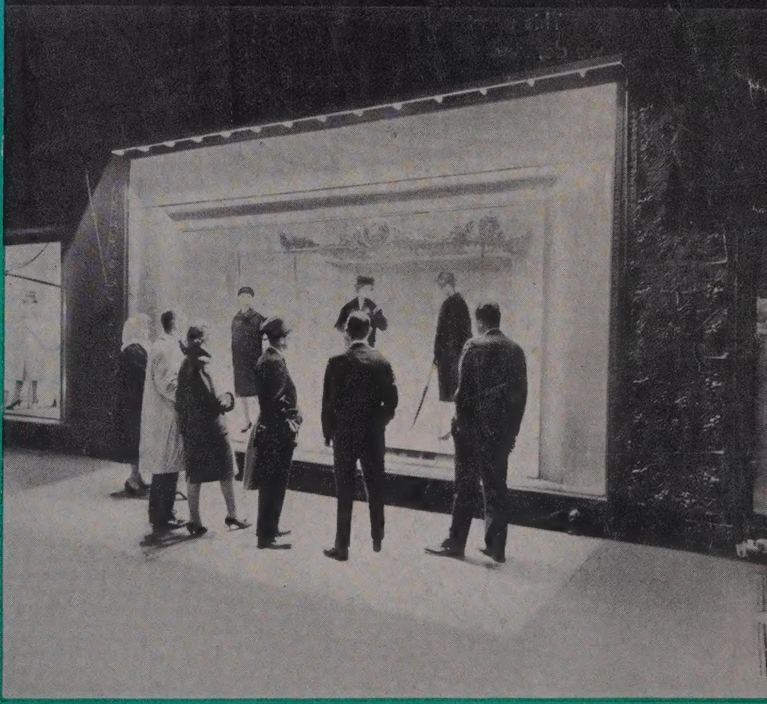
JUNE
1960

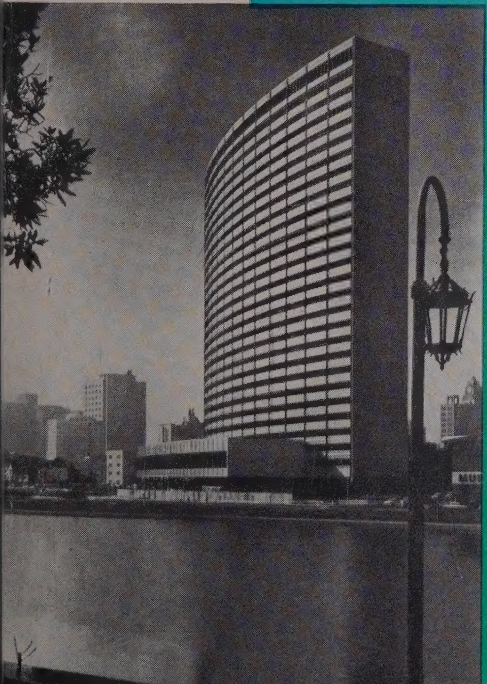
PRICE 75 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

Electric infrared comfort heating of open areas — a new market opportunity.





igh capacity network design
used in new
akland, Calif., headquarters
f Kaiser Industries.

N

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A McGRAW-HILL PUBLICATION | 59TH YEAR

HERE'S PROOF ...GUTH BRASCOLITES ARE REALLY RUGGED!

This unretouched photo shows how we demonstrate the rugged strength of Guth's Tetragonal design, Alzak Aluminum Reflector. Fred Guth (Mr. Chief Tester, himself) stands right on it! We *know* this rugged Guth reflector will hold at least 300 pounds!

This is typical of the quality and ruggedness you find in Guth Brascolite Incandescents. They're built for rugged duty PLUS optimum and long life lighting performance!

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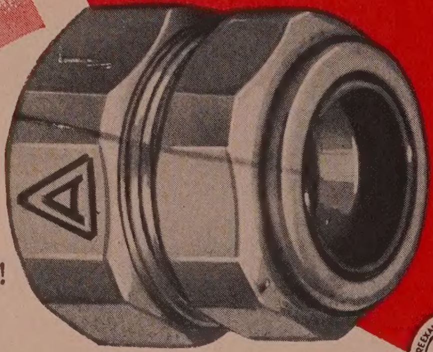
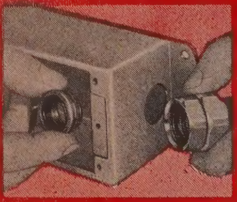
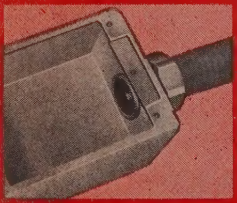


PATENT PENDING



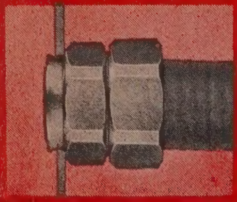
NEW LOCKING EDGE ON BODY

Special design of connector body locking edge bites into box wall and forms a constant, uniform seal . . . no welding . . . no locknut . . . always a positive ground!



MORE WIRING ROOM

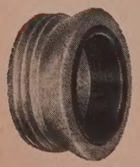
No projecting threads inside box. No weld. Wedge adapter hugs box wall almost flush when tightened. Forms "cold-weld" seal. No wrench needed inside box.



NEW WEDGE ADAPTER

Male shank of unique APPLETON wedge adapter "finger tightens" into connector body. Flared surface of adapter wedges box wall against locking edge of body. Forms full 360° contact on both sides of box wall.

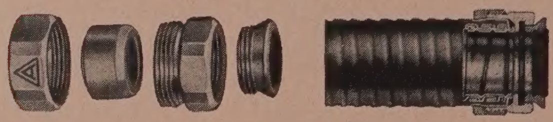
New Insulated Throat



Acetate, insulating insert recessed into wedge adapter absolutely protects against wire damage . . . without reduction in throat diameter. Perfect for extreme vibration conditions. Nothing to come loose, deteriorate, crack, or break!

The fastest, most economical and trouble-free method yet devised for making liquid-tight, flexible conduit connections is yours with the new APPLETON "STN" Sealtite Connectors. The exclusive wedge adapter used with all APPLETON liquid-tight fittings provides a lasting "cold-weld" seal. The "STN" provides a positive ground while the adapter pulls up almost flush inside the box to eliminate ragged edges and leave maximum wiring room. The acetate insulated throat protects wires without reduction of throat diameter! Only one wrench needed to install! Constant pressure of metal-to-metal seal resists vibration indefinitely! Full information and specifications available on request.

Patented Brass Ferrule Assures a Positive Ground . . . Crimping Excludes Liquids & Fumes from Connection



HERE'S HOW IT WORKS

Brass ferrule screws into spiralled inner wall of liquid-tight tubing forming continuous positive metal-to-metal ground. Compression nut and connector body crimps ferrule into outer neoprene wall to form permanent seal against liquids, fumes, and other foreign matter. Threaded shank of wedge adapter, when held in knockout hole, "finger tightens" into connector body. Locking edge on connector body bites into box wall when tightened (1/4 turn of wrench) and pulls adapter almost flush with inner box wall. A perfect installation every time . . . quick, easy, safe!

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Plain Prices, *An Editorial* 87

Infrared Comfort Heating of Open Areas 89

Chicago points way to infrared comfort heating of open areas as a new electrical installation market for contractor consideration. Quartz infrared tubes and lamps permit controlled application of heat and light with simple fixtures.

Sub-Feeder System Serves Gold Medallion Home 94

By W. T. STUART—Connecticut all-electric home has surface raceway enclosed feeders with CB controlled branch circuit taps on basement ceiling.

Estimating Forum—I 96

By RAY ASHLEY—Volume is no criterion of profits.

Wiring an Aluminum Showcase 97

Kaiser's new Oakland, Calif., headquarters features a high capacity secondary network for a 460/265-volt system.

Pre-Stressed Concrete Standards 101

Towers weighing 22,000 lb each were selected for lighting installation at Heidelberg Park baseball diamond, Tacoma, Wash., for long range economy, durability and architectural beauty.

Wiring Built-In Cooking Appliances 104

By J. H. WATT—While the 1959 NEC has clarified the status of built-in cooking appliances, a number of problems such as demand factors, branch circuit classifications, junction box sizes, and methods of grounding remain unsolved.

Cutting High-Voltage Splicing Time 110

An Atlanta contractor finds epoxy resin kits slashed man-hours required to make 4,160-volt splices and terminations on an industrial project.

Electric Heating in Apartments 112

By R. C. CORNELIUS—Over 75% of all apartment units built in Seattle, Wash., since 1954, have electric heat. A utility expert reveals why this trend can't miss spreading to other parts of the country.

MORE

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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Electrical Features of New Seattle Office Building 114

New structure offers high-level lighting, multilevel duct systems and combination of heating-cooling and lighting-ventilation.

The T-Connected 3-Phase Transformer 118

By P. A. VANCE—An analysis aimed at solving any "mysteries" of the 3-phase "T" transformer. Design, operation and application features of this unit are covered.

Practical Methods 128

Duplex induction unit heats brake drums; build racks to store wire; special dc breaker for rolling mills.

Motor Shops 143

Shop displays help generate sales; motorized dereeler for lamination stock.

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Questions and answers on lifting magnets; grounding control circuits; bake oven design; frequency changers.

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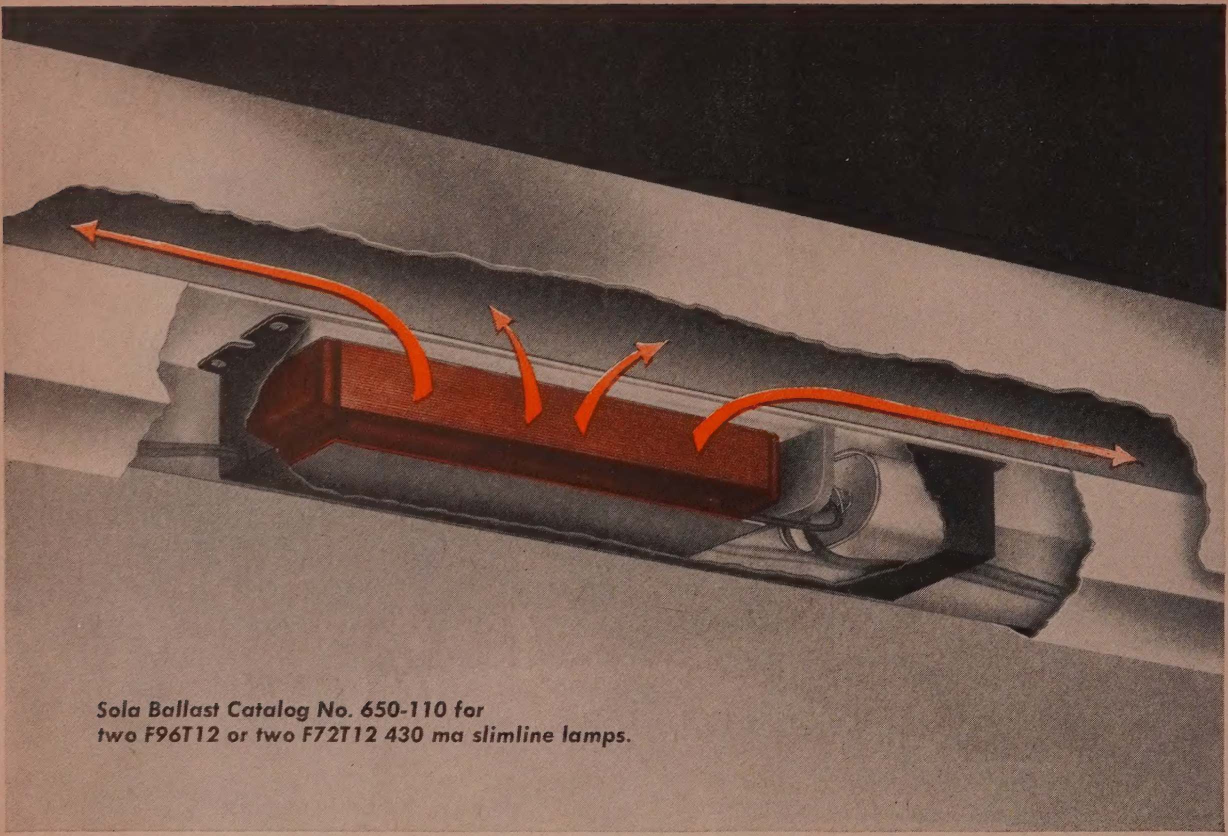

Sola Ballast Catalog No. 650-110 for two F96T12 or two F72T12 430 ma slimline lamps.

Upside-down insides make Sola's new slimline ballast work cooler, dissipate heat faster

Heat, the big enemy of fluorescent ballasts, is well on its way out thanks to a simple but extremely effective move by Sola ballast engineers. They mounted the components of their slimline ballast *upside-down.* This allowed them to remove the fiber insulator from the mounting surface of the ballast case. Now positioned beneath the label surface, it can't trap heat inside the case.

The normal heat generated by the core and coil is transmitted directly to the fixture housing where it is quickly conducted away. The fixture itself acts as a big cooling fin for the ballast. Additionally, a healthy margin of extra space is provided between the capacitor and the core and coil. This extends capacitor life.

All this adds up to a premium ballast that operates cooler, works more efficiently, and lasts longer. Despite this, it costs no more than conventional, hotter-running ballasts. You get premium performance now at no price penalty. The new ballast is CBM-certified to give full light output over its rated life.

You would be wise to capitalize on Sola's upside-down act when you next need ballasts for quality fluorescent fixtures, or for replacement where other ballasts gave up.

Write for Bulletin 26F-FL

SOLA

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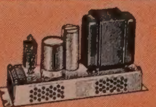

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Sidelights

CONSTRUCTING ELECTRICAL SYSTEMS

As reported on this page last month, our May editorial feature section "Constructing Electrical Systems" will be available in an attractively bound, hard-cover, book edition. Past experience has demonstrated that many of our subscribers and their associates want reference copies of our original and exclusive book-length projects in this more permanent form. The book edition is now on press and we expect to begin filling orders by about July 1. Single copies are priced at $4.50; in quantities of 10 to 24, $4.25 each and 25 or more copies, $4.00 each. Orders and inquiries should be addressed to the Editorial Department, Electrical Construction and Maintenance, 330 West 42nd St., New York 36, N. Y.

ALUMINUM SHOWCASE

Kaiser's new headquarters building, recently completed in Oakland, Calif., with nearly a million square feet of floor area, is now the largest office building west of Chicago. A high capacity secondary network serves a 460/265-volt electrical system with extensive use of aluminum for raceways and conductors. The curved floor plan also required a novel header duct installation to follow the building line. Associate Editor H. P. Scott describes the electrical system in "Wiring an Aluminum Showcase" beginning on page 97.

APARTMENT HEATING

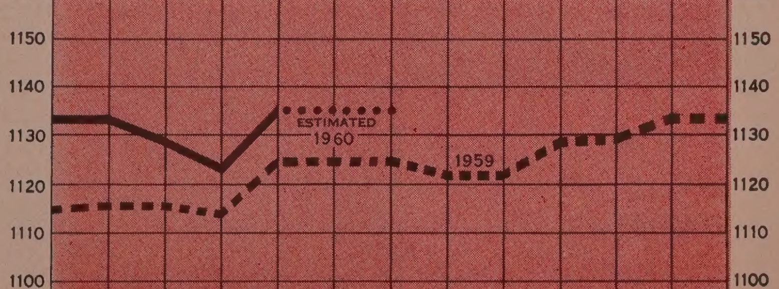
One of the most significant targets for the application of electric heating is new and modernized apartment buildings. In areas where attractive all-electric rates are available, the advantages are so compelling to building management and tenants alike that electric heat systems may rapidly make conventional heating plants for multi-family buildings obsolete. In Seattle, Wash., 75% of all apartment units built since 1954 have electric heat, a trend which is already spreading to other parts of the U. S. R. C. Cornelius of Seattle City Light tells why in "Facts Focus on the Future of Electric Heating in Apartments" beginning on page 112.

NISA AT MIAMI BEACH

Electrical apparatus service shop men took a long range look at managerial and operational problems that will accompany anticipated increases in service business during the next decade at the annual convention of the National Industrial Service Association at Miami Beach last month. Associate Editors August Eckel and Berlon C. Cooper report on the meetings and convention activities beginning on page 216.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



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Washington Report

JUNE • 1960

A deterioration of East-West relations seems almost certain following the break-up of the Summit meeting in Paris in mid-May, as Soviet Premier Nikita S. Khrushchev reverted to the usual Communist strategy of "protracted conflict," which both military and political officials in Washington have previously recognized and specifically described.

As uncertainty becomes the theme for the future, certain probabilities seem likely: Defense appropriations will probably be boosted; Eisenhower's foreign aid request for $4.2 billion will probably be approved in full. While defense output cannot be pushed up suddenly and sharply, new defense needs will almost certainly affect many aspects of business—soon on manpower, slowly on inventories. A pickup in business this fall, directly related to increased defense spending, is expected.

Business has displayed a firmer tone since the beginning of the second quarter, quite aside from the international situation. Personal income is rising, retail trade has turned up firmly, employment gains were made between April and May, auto production rose during May to what was expected to be the best May since 1955, and home building has halted its decline with a slight upturn.

Desertion of conservative policies in public spending could cripple this nation, and would play into the hands of the Soviets, Budget Director Stans declared recently in a speech before the U. S. Chamber of Commerce. He pointed out, however, that the Soviets are now a long way behind the U. S. in the development of their economy and their standard of living. He suggested that, as the nation's output of goods and services increase, we should reduce the national debt, relieve the tax burden, as well as take care of real national needs.

New construction spending rose to $4 billion in April, up from $3.7 billion in March. New private construction increased $200 million over March, to $2.9 billion, and public construction rose $100 million, to $1.1 billion. All totals were below the levels of a year earlier.

Capital investment in industry this year will total nearly $38 billion, or an increase of about 14% over last year's activity, according to a recent McGraw-Hill survey of business intentions. This is slightly above the previous peak reached in 1957 and confirms an earlier Dept. of Commerce-Securities & Exchange Commission survey.

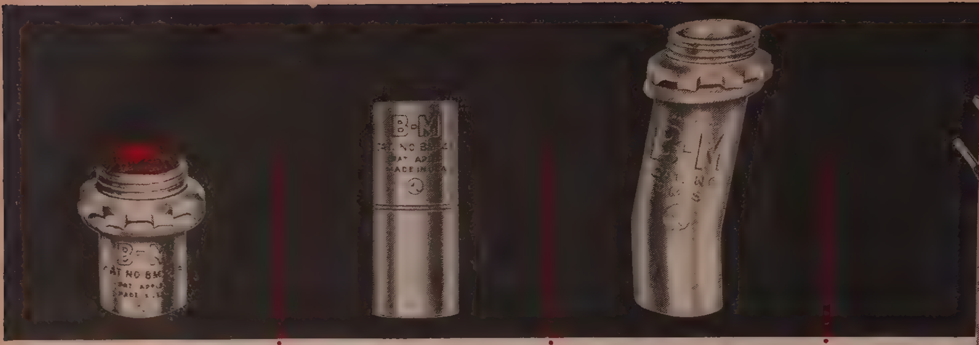
School construction requirements over the next ten years add up to $26.8 billion, for 607,600 classrooms, according to a recent report by the U. S. Office of Education. This includes the existing backlog of needed classrooms, replacement of rooms that become obsolete or destroyed over the next ten years, and additional classrooms needed for the increase in pupils during the coming decade.

Housing starts in April increased seasonally to 110,400, from 93,800 in March, April starts last year totaled 142,200. Most builders now report mortgage funds as more plentiful.

Gross national product for the first quarter was $498 billion, Dept. of Commerce reported. This is just short of the "half-trillion dollar" economy which most economists have been discussing recently. This is an increase of $14.5 billion from last year's fourth quarter.

Other economic highlights:

- Industrial output in April was 109% (of the 1957 average) (old index—165% of the 1947-49 average).
- Employment soared to 66,150,000 in mid-April, a record for the month, while unemployment fell to 3,660,000.



Red Throat
BM-21B
½″ Connector
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1″ Connector

BM-41
½″ Coupling
BM-42
¾″ Coupling
BM-43
1″ Coupling

BM-51
½″ Offset Connector
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¾″ Offset Connector

BM Offset
Connectors
showing how
wires are
guided over
box edge.

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Save time and money with

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Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.

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ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT

When setting E.M.T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as Concrete-Tight. Contractors everywhere recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E.M.T. connectors and couplings.

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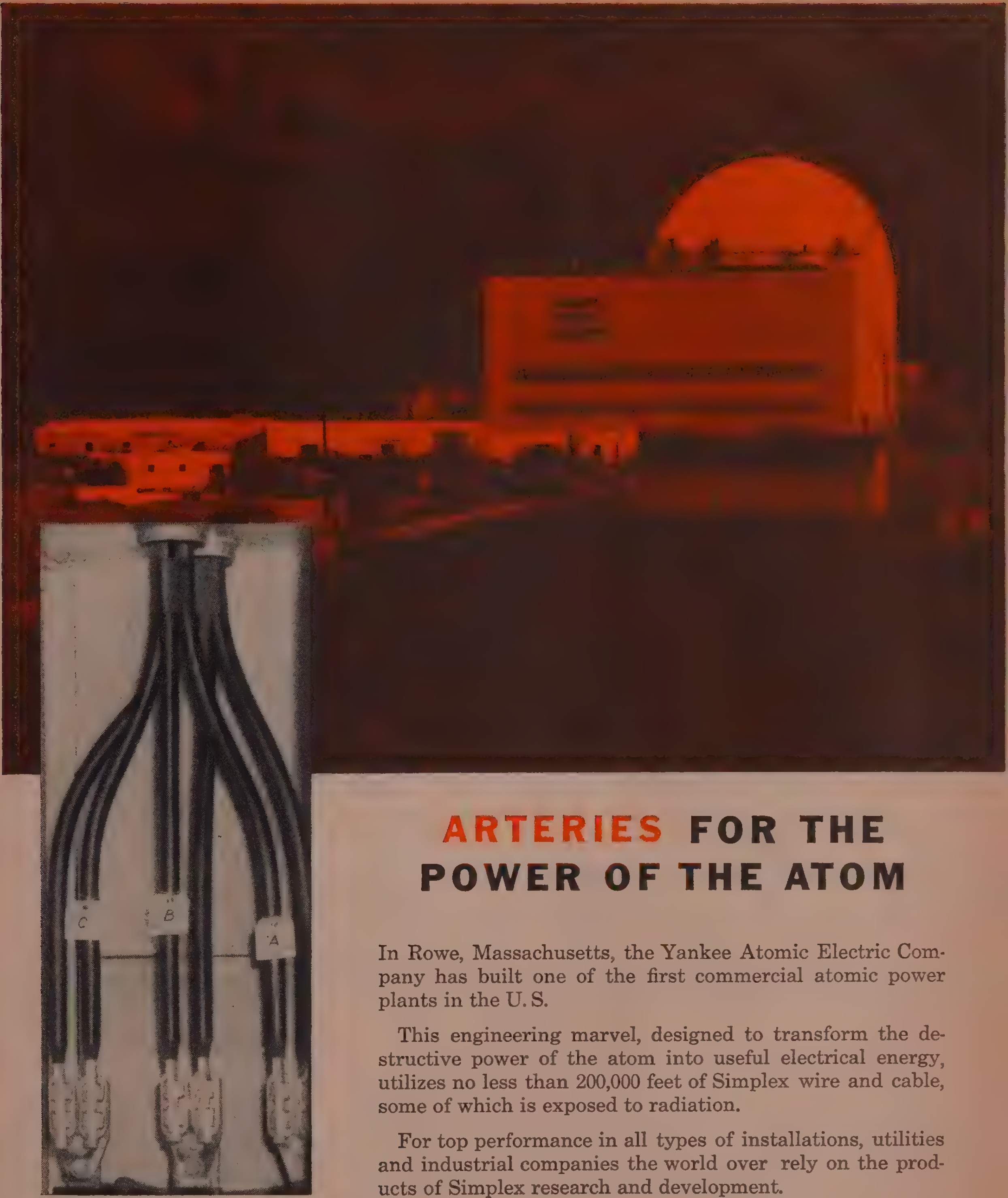

ARTERIES FOR THE POWER OF THE ATOM

In Rowe, Massachusetts, the Yankee Atomic Electric Company has built one of the first commercial atomic power plants in the U. S.

This engineering marvel, designed to transform the destructive power of the atom into useful electrical energy, utilizes no less than 200,000 feet of Simplex wire and cable, some of which is exposed to radiation.

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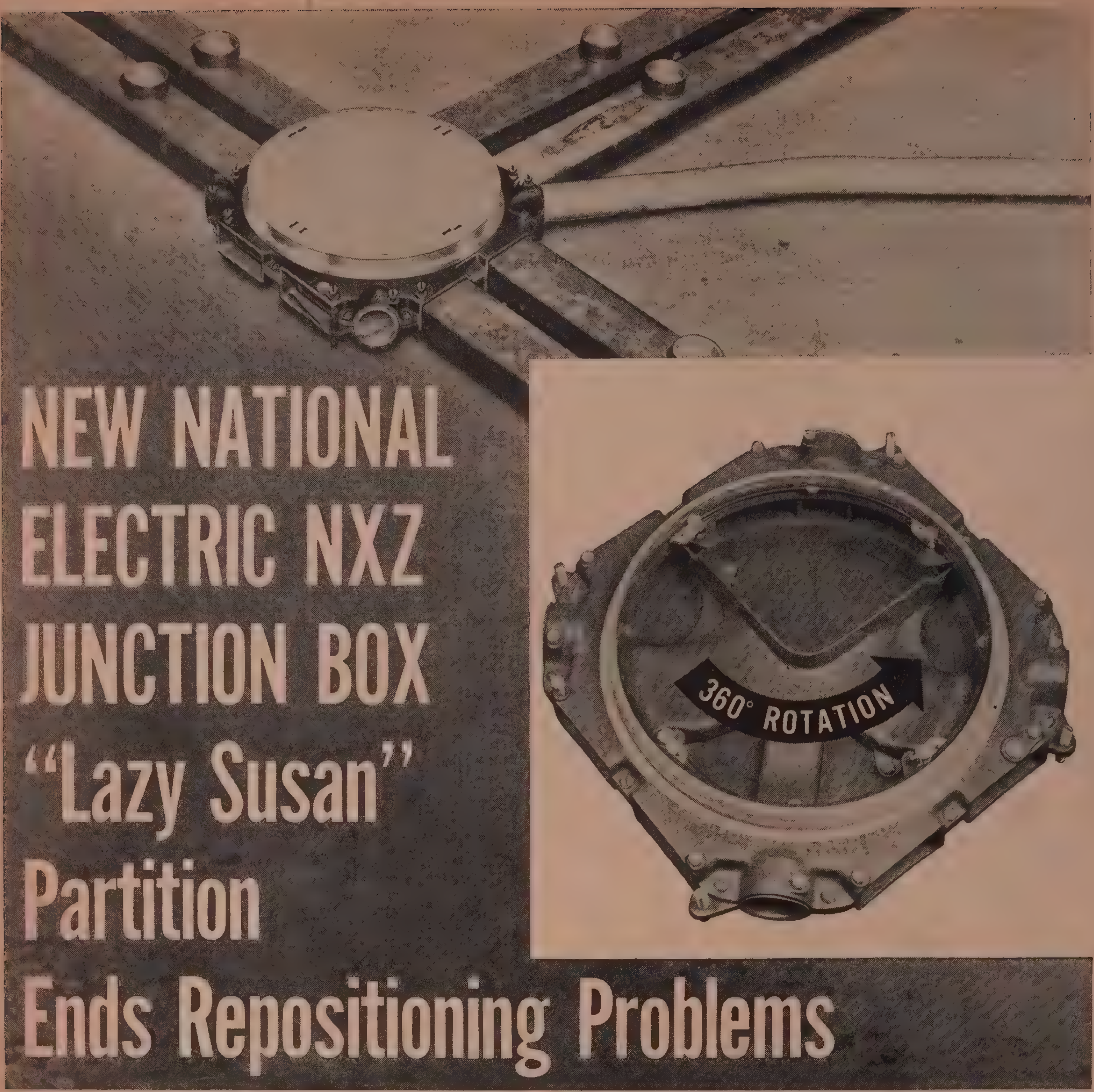

NEW NATIONAL ELECTRIC NXZ JUNCTION BOX “Lazy Susan” Partition Ends Repositioning Problems

The unique “Lazy Susan” partition in the new National Electric “NXZ” Junction Box ends all the costly repositioning problems encountered when a box is installed with partitions not properly oriented with the underfloor raceway system. By removing two screws inside the “NXZ” box and rotating the “Lazy Susan” partition, the costly procedure necessary to reposition the box is eliminated. Contractors report a substantial savings when using this improved method.

In addition to the ease of realigning the box, the “NXZ” line offers the advantage of being able to adjust the box height without removing the cover . . . using an ordinary screw driver. As with all National Electric Junction Boxes, a galvanized steel collar around the leveling ring keeps concrete from bonding to the ring, thus allowing downward adjustment.

National Electric “NXZ” Junction Boxes are part of a complete underfloor raceway system suitable for all types of construction. For complete details on underfloor raceway systems, write to *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.*

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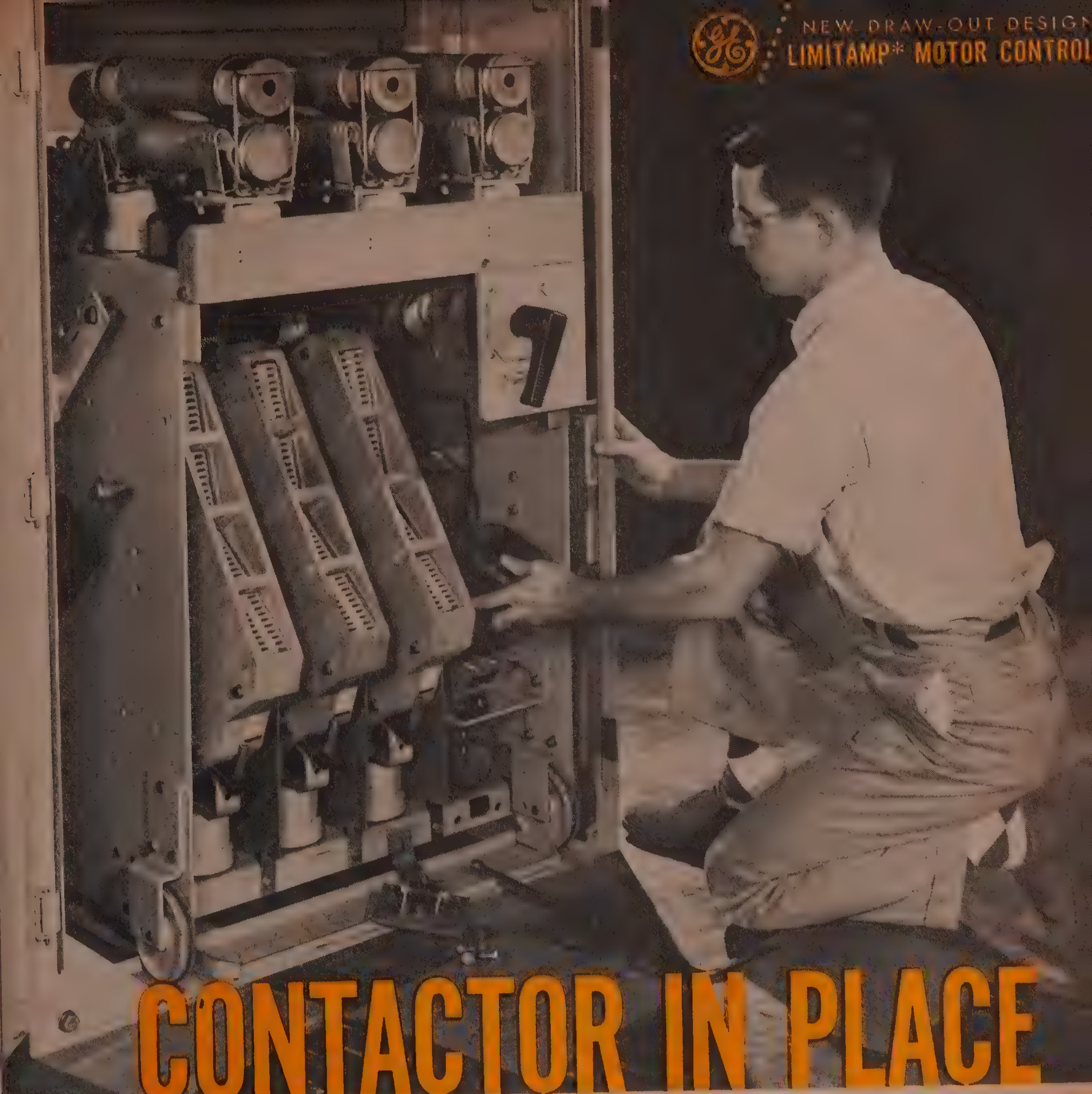
NEW DRAW-OUT DESIGN
LIMITAMP* MOTOR CONTROL



CONTACTOR IN PLACE

. . . speeds Limitamp control inspection and maintenance

Rated 2300- to 4600-volts for a-c motors up to 3000 hp.

Maintenance is an easy job with General Electric's new draw-out Limitamp control. Routine maintenance is quickly performed with the contactor in place.

Coils and contact tips can be changed in a matter of minutes. Simply lift out the arc chutes and one arc horn to expose the bolts holding coils and tips in place.

To make your job still easier, a magnet-head wrench is supplied with each unit. This wrench fits all bolts necessary to change coils and tips. And, remember . . . Limitamp control is all front connected.

To replace fuses, you just pull the ejector and the fuses pop up. When a fuse is replaced, it is guided into position by a back-stop on the clip.

Another feature of new Limitamp control is a special test circuit—built into each control unit. Simply bring in external control power and connect it to the terminal board. You can then safely operate the panel—isolated from its normal power source with the door open—to check out the unit before putting it into service.

Ask your G-E Apparatus Sales Engineer or Agent about other advanced-design maintenance, installation, operation and performance features of Limitamp control. Or, write Sect. 783-14, General Electric Co., Schenectady, N. Y. for Bulletin GEA-6893. Industry Control Dept., Salem, Va.

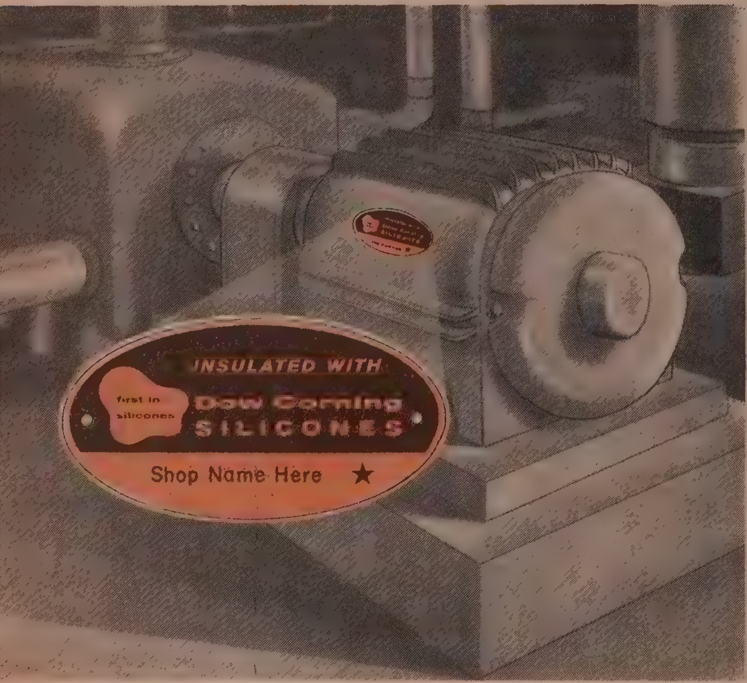
Progress Is Our Most Important Product

GENERAL ELECTRIC

* Reg. Trade-mark of General Electric Company

SILICONE NEWS from Dow Corning

Better Than New...Cost Less Too



Silicone Rewinds Provide Extra HP to Handle Increased Loads . . . Overloads

From coast-to-coast, from Canada to the Gulf, nearly 200 Service Shops are now qualified and equipped to rebuild motors from your plant so that they will deliver from 25% to 50% greater horsepower than they did as originally supplied.

Service Shops identify these motors by affixing brass plates that read "Insulated with Dow Corning Silicones" . . . and bear the shop name.

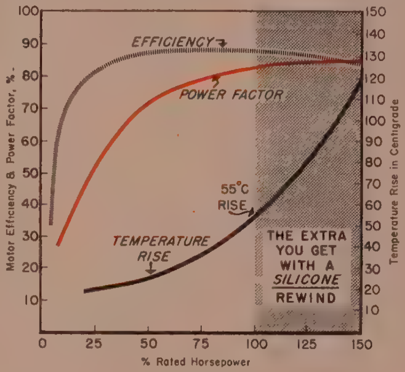
Where motors in your plant have failed because of increased production schedules . . . a change in processing or machining techniques . . . rapid reversing . . . jogging . . . inching . . . temporary or continuous overloading . . . a silicone rewind is the cost saving solution to minimum downtime and future reliability.

Or if you're planning new processes, new schedules that will increase horsepower requirement of existing motors, consider these facts: Your present motors can be rewound with silicones for a fraction of the price of new motors — and you save the cost of new motor pedestals and mounts, fittings, wiring and controls. Furthermore, you save considerable installation time and expense.

Silicone rewinds give reliable operation in almost any surrounding — regardless of high ambients, moisture, many corrosive atmospheres. For more information, and the name of Authorized Service Shops near you, contact Dow Corning, Dept. 2806.

first in silicones
DOW CORNING
SILICONE INSULATION
AUTHORIZED SERVICE SHOP
★

SERVICE SHOPS identified by this gold emblem are experienced in rebuilding motors . . . in the use of silicone insulating materials to assure top quality performance.



MOTORS REWOUND with Dow Corning Silicones give up to 50% more horsepower. Efficiencies and Power Factors are comparable to those at full load ratings of motors as originally supplied. Only the insulation changes. The extra thermal stability of silicones increases motor capability.

SILICONE REWINDS consistently produce outstanding results such as these: To increase pumping capacity 30%, thirty-one 50 and 60 horsepower pump motors were rewound with silicones — boosting their output from 50 to 75 horsepower, from 60 to 90 horsepower. Total cost was only $19,000 compared to $68,200 for new motors and mounts! After 4 years, the motors have proved 8 times more reliable!

SPECIFY Dow Corning Silicones
and **SAVE!**

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

NOW YOUR CUSTOMERS CAN
LEASE LIGHTING
from Smithcraft
and General Electric Credit Corporation

Smithcraft LEASE-LIGHT* is a new nation-wide plan by which owners or tenants can lease Smithcraft fluorescent lighting equipment for old or new buildings.

- Owners or tenants free their capital to earn dividends while enjoying the efficiencies of Lease-Light*.
- They rent or time-pay for the entire lighting equipment, including installation cost, anywhere in the United States or Canada.
- They lease for 5 years . . . deposit approximately 5 months rent . . . 10 months if installation cost included.
- Your customers Lease-Light* from Smithcraft through you and your Distributor. Their payments are sent to General Electric Credit Corp.
- Lease-Light* rentals for recommended lighting levels for stores, offices, factories and schools run as low as ¾¢ per square foot per month.
- Your customers choose from Smithcraft's complete line of fluorescent fixtures or light- and sound-conditioned ceilings.

You can generate more jobs in the modernization and re-lighting market, at a higher profit to you, with the Smithcraft Lease-Light* Plan. For further information, call your distributor or write to

CHELSEA 50, MASS.
233 Everett Ave.

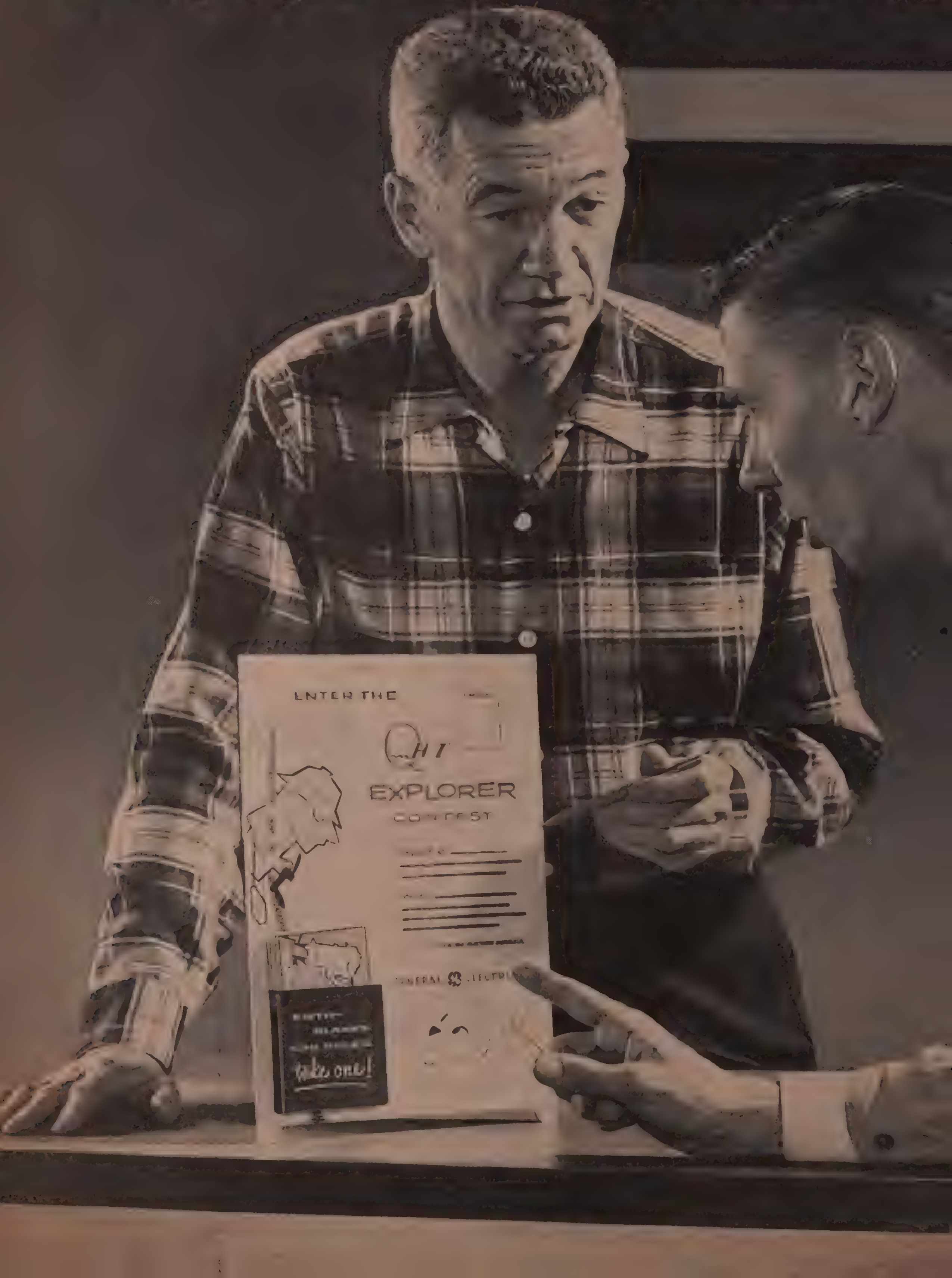
Smithcraft
CORPORATION

CHICAGO 30, ILL.
5475 N. Northwest Highway

Light-conditioning by Smithcraft—America's finest fluorescent lighting

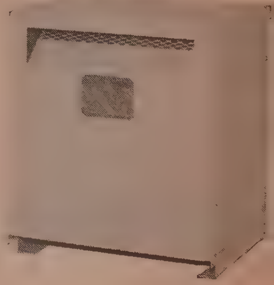
*Registered Mark Smithcraft Corporation

"George, you should KNOW all



the features of these QHT* dry-types"

. . . that's right, KNOWING the features of QHT dry-type transformers means satisfaction, can save time and money, and may win you a vacation of your choice in New York, Miami, Las Vegas, or Los Angeles



General Electric QHT dry-type transformers provide a balanced combination of small size, light weight, superior installation features, high-temperature insulation, and quiet operation. This combination means easier installation and practically eliminates the major sources of transformer complaints—noise and insulation failure. Review these features:

Ease of installation. These General Electric QHT dry-types are built with convenient conduit knock-outs, large terminal compartments, and wiring spaces which are easily accessible from the front. You'll save time and money every time you install one.

Quiet, high-temperature operation. All QHT transformers have sound levels equal to or less than NEMA Standards. The rigid, welded design of the units helps eliminate vibration, and built-in rubber mountings reduce noise transfer through conduits and mounting brackets. QHT dry-types have silicone-impregnated insulation, highly moisture resistant, with an inherent ability to withstand high operating temperatures.

Small size, light weight. Because these new QHT dry-type transformers are built of quality, weight-saving materials such as aluminum conductors and cold rolled, grain-oriented silicone steel, you get a unit that's lighter and smaller than old type designs. You'll save space and money in installation by putting these new transformers right at the load.

Fast delivery. Complete stocks of these new General Electric QHT dry-type transformers are available at your local G-E electrical distributor. See him today for all the information on what these QHT features mean to you. And ask him for details on the "QHT EXPLORER CONTEST"—he'll give you all the details and an entry blank.

*Registered Trademark of General Electric Co.

announcing the

QHT *dry-type transformer*

EXPLORER CONTEST

. . . You can win a vacation for two in your choice of New York, Miami, Las Vegas, or Los Angeles, or one of 1400 other prizes, simply by exploring the world of extra values in General Electric QHT dry-type transformers. Call your G-E dry-type transformer distributor and ask him for details on the "QHT EXPLORER CONTEST"—he'll give you all the details and an entry blank.

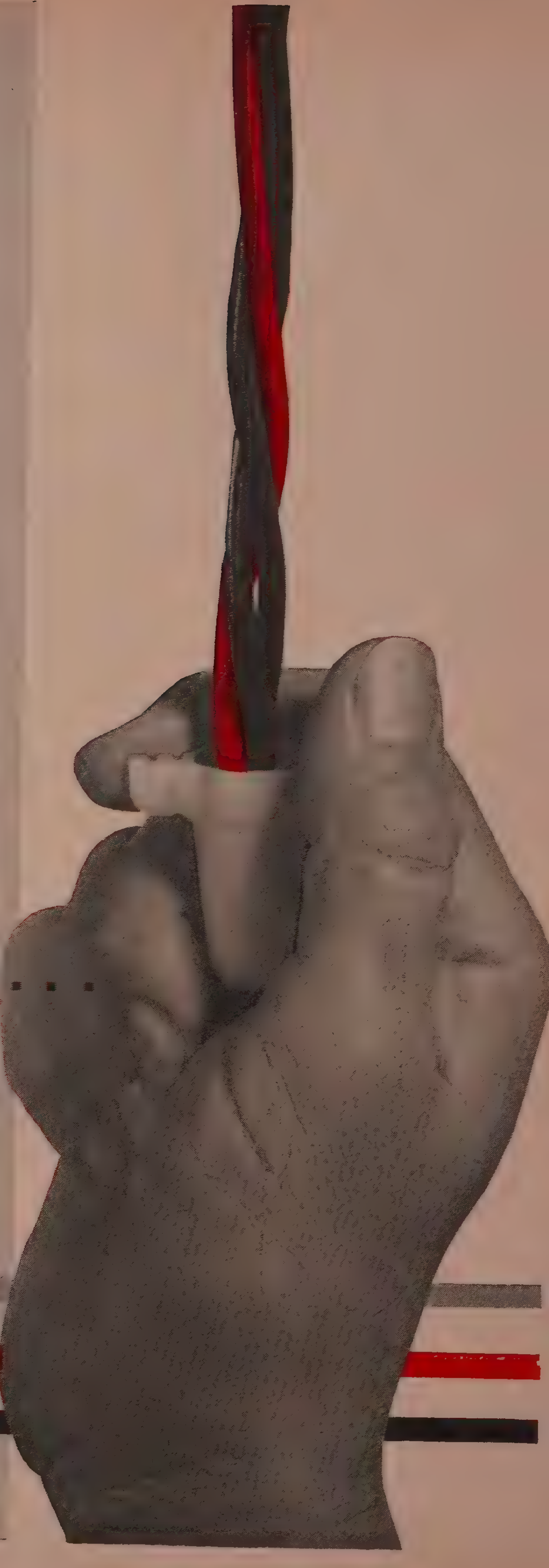
411-14

No entries will be accepted from employees of the General Electric Company or its subsidiaries.

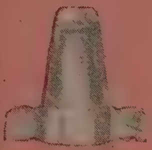
GENERAL ELECTRIC

What?
Splicing a
branch circuit
without tools?

YES!
because only
WING-NUT
has a built-in wrench . . .



© 1960, IDEAL INDUSTRIES, INC., Sycamore, Illinois



This one really has it! Here's the *only* one-piece screw-on wire connector with the unique wing grip. Good news for thumb-sore electricians . . . just twist Wing-Nut easily and quickly on even the toughest branch circuit wires, like stiff vinyl-insulated #6. It's so easy, no tools are needed. And in crowded boxes apply Wing-Nut, then snip off the wings.

Perfect splice? You *know* it! Your splice is always visible—no take-apart for inspection. You can actually *see* your splice is right, through the semi-transparent Nylon insulating shell. And that Nylon shell is tough, unbreakable, high-dielectric, and stable . . . won't cold-flow and short-out by stretching thin under strain or pressure.

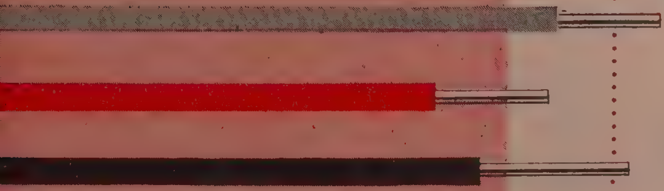
Only Wing-Nut has a Nylon shell with such a deep, wide skirt. Easily slips over two No. 8 and a No. 6, even thick Type RW. No flash-over. Two sizes of Wing-Nut handle all your needs.

Aluminum wire, too! **U.L. has approved Wing-Nut for use as a pressure cable (600v) and fixture splicing connector for all possible combinations of standard aluminum-to-aluminum wire splices. And only Wing-Nut is also approved for 474 combinations of solid and/or stranded copper wire.**

Sound good? Then see and try the new Wing-Nut yourself.

WRITE FOR FREE SAMPLE

IDEAL



For the tools and supplies you need on every wiring job, get the finest

MADE BY IDEAL

NEW—FOR DIFFICULT PULLING JOBS

"FLEXI-STRAND", Ideal's new extra-flexible fish tape answers the problems of pulling wires around sharp bends. It is made of high quality preformed galvanized aircraft cable. It is more durable, and stronger, and will far out-last ordinary flat tapes. So flexible it will easily take sharp bend in any conduit without cutting. Takes extreme flexing without kinking or taking a set. Extremely high breaking point of 2,500 lbs.

"WIRE-LUBE" FOR EASIER WIRE PULLING

Easily applied by hand or brush to any rubber, or plastic-covered wire or cable, as they are being pulled into conduit. Wire-Lube protects insulation against breaks, scrapes and strains. Slides wires around bends and thru tight spots. Dries to a fine lubricating powder that makes it easy to add or remove wires later. Noncorrosive, noncombustible, absolutely harmless to hands and clothes.

SUPER-SAFE VOLTAGE TESTER

Safest, easiest-to-use voltage tester made. Designed for rugged daily use. Case is seamless plastic in Safety Yellow, with no surface metal. Prods have extra-safe no-slip grips and 30" neoprene leads. Case has center mount for one prod, with prod storage space to completely shield tips. Test for: VOLTAGE (110 to 550v AC; 110 to 600v DC) FREQUENCY (25 to 60 cycles), AC or DC. Solenoid calibrated voltage indicator functions separately from neon test lamp for super-safety. Available with special current-limiting resistors in each prod.

"E-Z" AUTOMATIC HAND STRIPPER

Strips standard branch circuit, fixture and lamp wire, and all other stranded or solid wire. Automatic stop locks jaws open after stripping until wire is removed. Eliminates crushed wire ends. Available with eccentric adjustment on blades to limit cutting depth.

"T-5" LOW COST STRIPPER

A handy addition to every electrician's tool kit. Strips No. 10, 12, 14, 16 and 18 gauge wires quickly, cleanly, easily. Cuts and loops wire. Sturdy, compact, constructed of hardened steel for rugged duty and long service. Comfortable plastic grips for sure handling and safety. Overall size, 6". Flat design fits easily into pocket or tool kit.

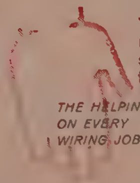
"SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS"

In Canada: Irving Smith, Ltd., Montreal

IDEAL INDUSTRIES, Inc.,
1041-F Park Avenue, Sycamore, Illinois

IDEAL

Yes! I want the full story on the new Wing-Nut, and my free sample to try on the toughest branch circuit splice I can find. Also send me information on the full line of Ideal connectors, tools and supplies.



THE HELPING HAND ON EVERY WIRING JOB

Name______________________________

Firm______________________________

Address______________________________

City________________Zone_____State__________

the latest lighting advancement from...

APPLETON®
electric company

first

lighting unit to give you top operating performance from the amazing Quartzline lamp!

Intenso® "QUARTZLITE 500"

Only the Appleton *Intenso* "Quartzlite 500" is precision engineered to meet the lamp manufacturer's efficiency and operating standards for the new 500-watt, filament type, iodine cycle lamp.

Its new, compact design was specially developed for this powerful lamp to give you 19% greater, *constant* light output of 21 lumens per watt . . . and twice the average life of a conventional 500-watt lamp.

That's not all! For the first time, attractive lighting installations can be made in very small space areas — easily, economically. The special weatherproof unit design also puts light where you want it. Its extremely sharp cutoff—in a rectangular beam spread—eliminates the usual need for beam overlap, yet provides adequate, uniform light for innumerable applications indoors and out.

For increased lighting efficiency in Industry • Business • Recreation • Transportation, buy or specify the versatile *Intenso* "Quartzlite 500". . . ideal for signboards, displays, outdoor sports, building security, mobile equipment, storage areas and many other uses.

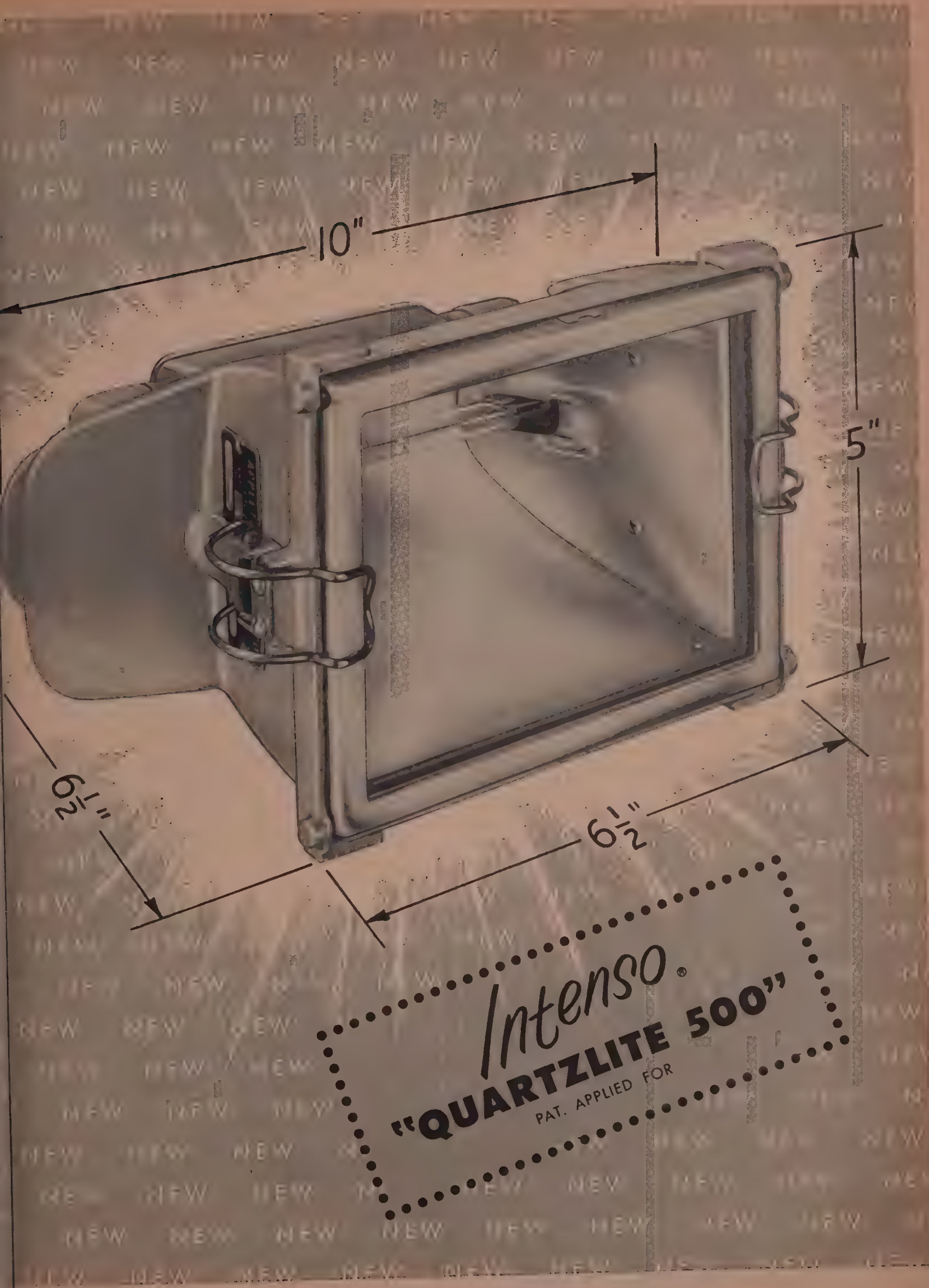
WRITE TODAY FOR COMPLETE DETAILS

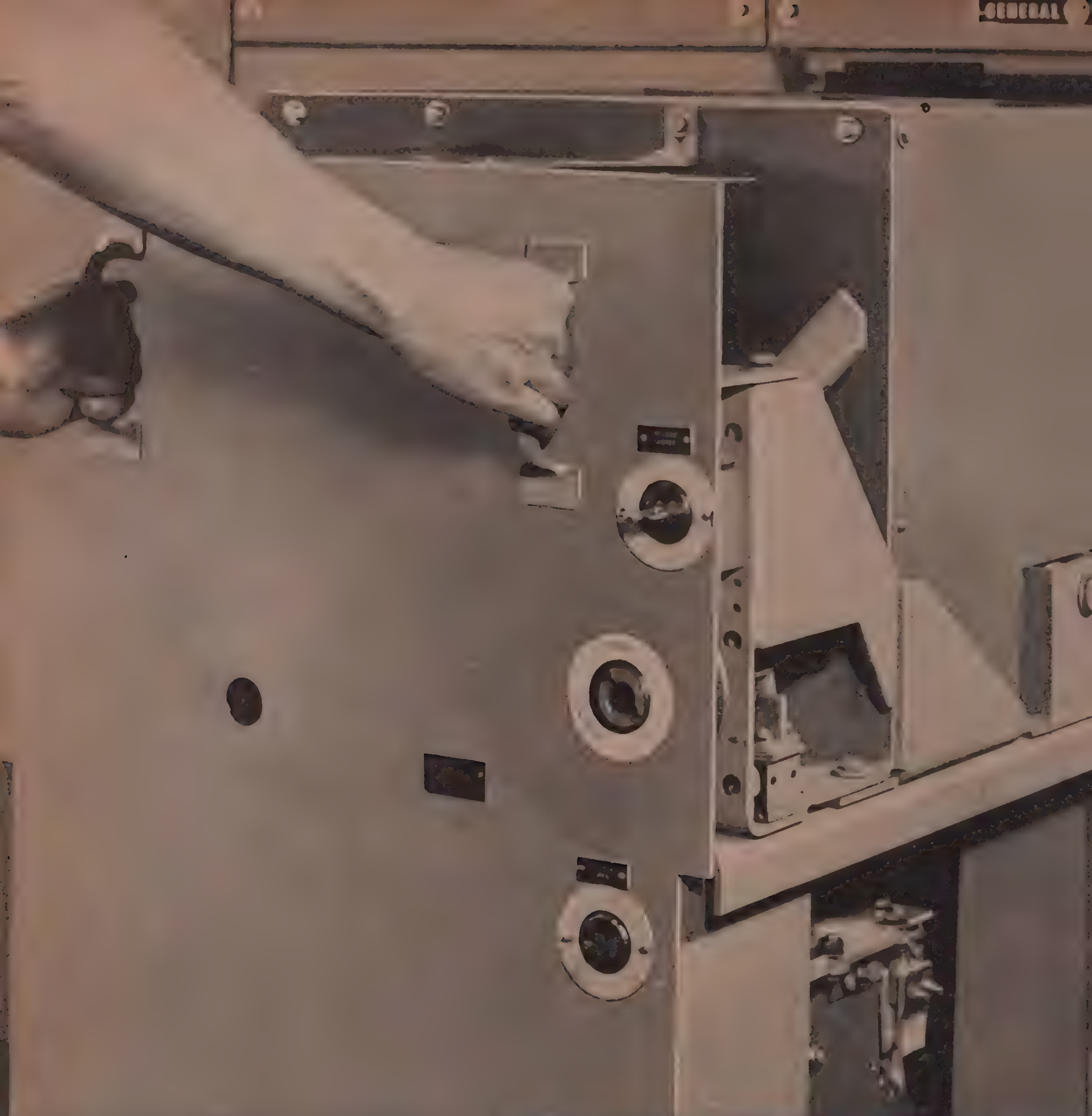
APPLETON ELECTRIC PRODUCTS

APPLETON®

Sold through franchised distributors only

electric company
1701 Wellington Avenue, Chicago 13, Illinois


10"
5"
6½"
6½"
Intenso®
"QUARTZLITE 500"
PAT. APPLIED FOR



AS ACCESSIBLE AS A FILE DRAWER, G-E Roll-out Switch and Fuse Equipment (available in 2.4 to 13.8 kv ratings) combines maximum safety with ease of inspection and maintenance.

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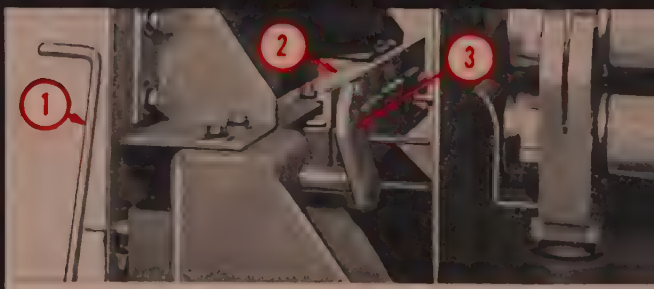

YOU GET GREATER SAFETY because (1) new, removable, single-stroke handle "charges" the operating spring safely, easily. (2) High speed closing and consistent contact opening are provided by one spring which works independently of operator. (3) Positive interlock gives greater safety for operator and equipment.

Here's how
General Electric
Rollout Switch and
Fuse Equipment makes...

TH
BIG
DIFFERENC

in reducing fixed and operating costs for light duty switching and circuit protection

Greater safety, better short-circuit protection, easier installation, and reduced maintenance—these are the features of General Electric Rollout Switch and Fuse Equipment that play an important role in reducing your fixed and operating expenses.

Precision-engineered components make another "Big Difference." A new manually-operated, stored-energy load-break switch provides both high-speed closing and consistent, sure contact opening independent of the operator. High quality current-limiting fuses and interrupter switches help assure rapid, sure switching and fault current protection.

Evaluate for yourself the difference this equipment can make in both commercial and industrial systems. For all the facts, contact your nearest G-E Apparatus Sales Office or write for bulletin GEA-6623B, General Electric Co., Schenectady 5, New York. 514-06

Progress Is Our Most Important Product

GENERAL ELECTRIC

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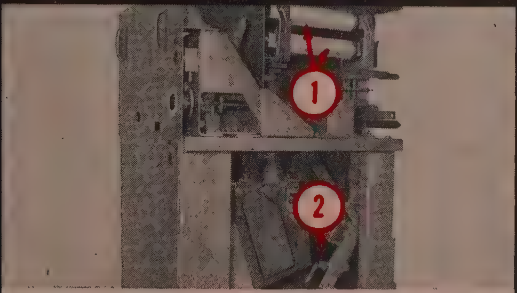

GENERAL ELECTRIC ROLLOUT SWITCH AND FUSE EQUIPMENT has (1) current-limiting fuses on the source side of the (2) load-break switch. This feature means you get greatly improved short-circuit protection.

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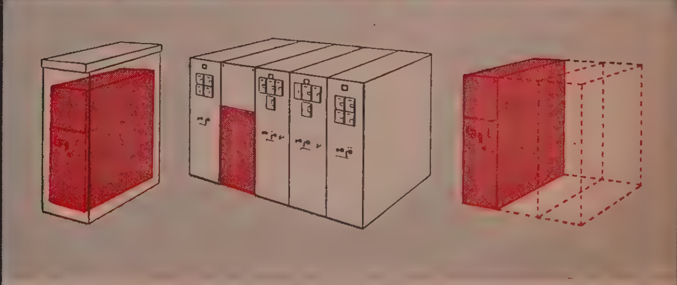
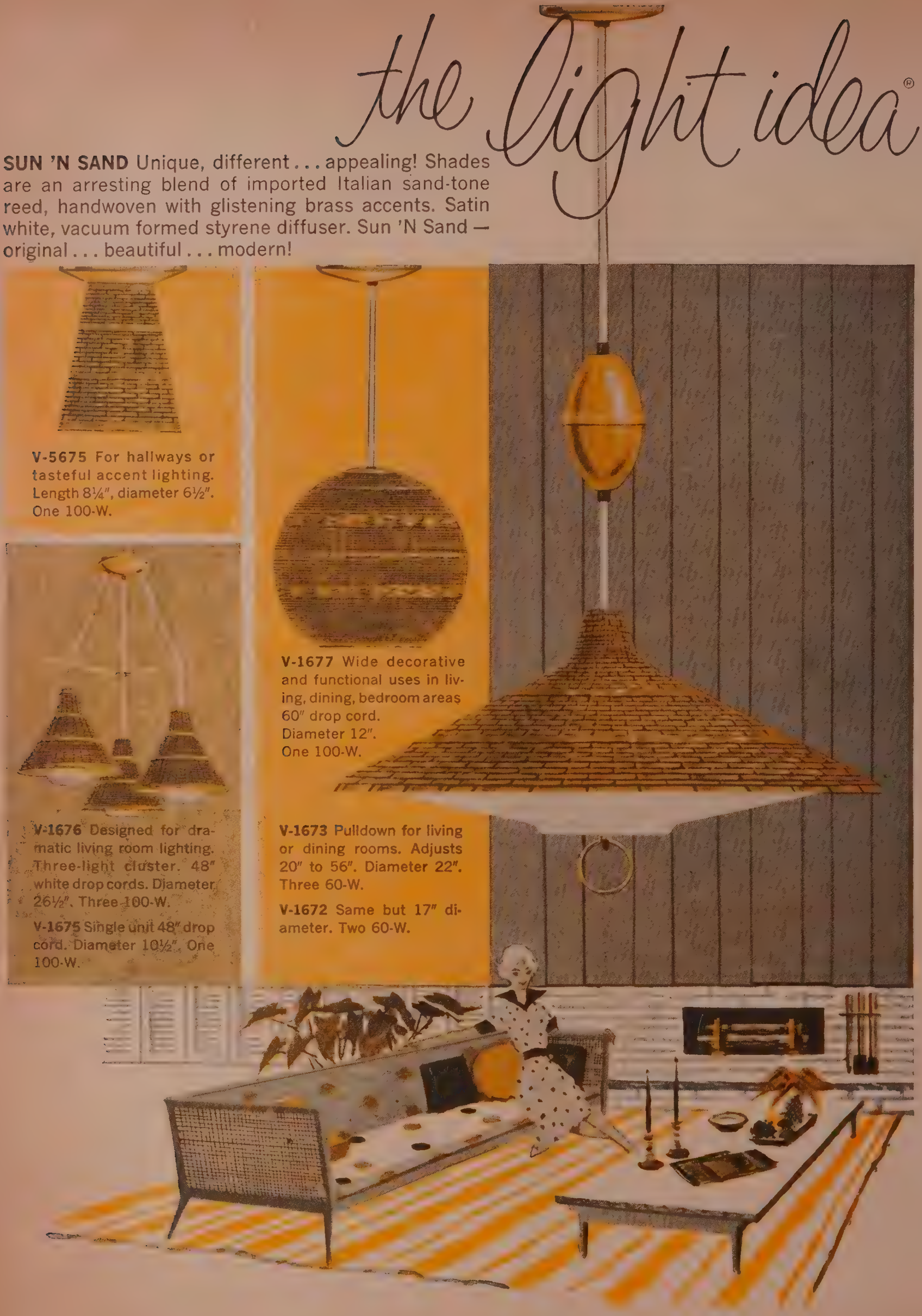


YOU HAVE A CHOICE of construction types. G-E Rollout Switch and Fuse Equipment can be furnished to suit your installation needs—indoor or outdoor units; in line-up with G-E Metal-clad Switchgear; or in single or multiple units.

the light idea®

SUN 'N SAND Unique, different . . . appealing! Shades are an arresting blend of imported Italian sand-tone reed, handwoven with glistening brass accents. Satin white, vacuum formed styrene diffuser. Sun 'N Sand — original . . . beautiful . . . modern!



V-5675 For hallways or tasteful accent lighting. Length 8¼", diameter 6½". One 100-W.

V-1677 Wide decorative and functional uses in living, dining, bedroom areas 60" drop cord. Diameter 12". One 100-W.

V-1676 Designed for dramatic living room lighting. Three-light cluster. 48" white drop cords. Diameter 26½". Three 100-W.

V-1675 Single unit 48" drop cord. Diameter 10½". One 100-W.

V-1673 Pulldown for living or dining rooms. Adjusts 20" to 56". Diameter 22". Three 60-W.

V-1672 Same but 17" diameter. Two 60-W.

new custom creations

FLORENTINE SERIES Exquisitely detailed scrolls cast in aluminum. Antique white color delicately toned with gold fleck. White opal globes. Matching white chain. Here is new richness for all homes — contemporary, transitional, traditional!

V-1713 Perfect in foyers, living rooms, dining areas. Spread 31″ (6′ chains and yolk). Three 100-W.

V-1712 Majestic! Diameter 12″. Matching white 6′ drop chain. V-1710 diameter 10″. One 150-W.

PLANTER SERIES Bright ideas! Lighting fixtures that double as planters. Perfect accents for fireplace, entranceways, in dinettes or family rooms . . . wherever you want a touch of eye-catching beauty!

V-1690 Polished brass. Diameter 15½″. Length 36″. Lights from top. Three 60-W.

V-1695 Planter for wall mounting. Diameter 5½″ (top and bottom). Length 33″. Lights from top. One 60-W.

These are just a few of the fresh, new custom creations available...fixtures so delightfully different and irresistibly styled..."to show is to sell." Free colored brochure describing the full line available. See your nearest Virden Lighting distributor or write direct using the coupon below.

VIRDEN Lighting

VIRDEN LIGHTING

MEMBER AMERICAN HOME LIGHTING INSTITUTE

VIRDEN LIGHTING DEPT. ECM-6
DIVISION OF JOHN C. VIRDEN COMPANY
5209 EUCLID AVENUE
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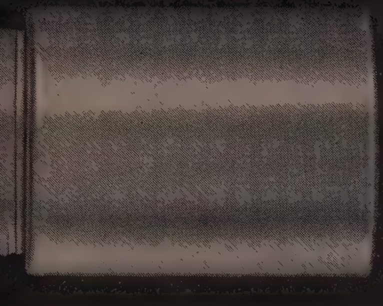
SUBSIDIARIES: LIGHTING DYNAMICS, INC., LOS ANGELES, CALIF. AND DALLAS, TEXAS; JOHN C. VIRDEN, LTD., TORONTO, ONTARIO.

ALCOA
ALUMINUM
CONDUIT
Underwriters' Laboratories, Inc.
INSPECTED
RIGID CONDUIT
ISSUE MR-41

Why *this** rigid conduit?



**instead of conventional steel conduit*

Because it weighs less. Alcoa aluminum rigid conduit goes up faster than conventional steel conduit. From warehouse to erection site, there's only ⅓ as much weight to lift, load, carry, and erect.

Because it's easier to cut. A hacksaw on the small sizes or power tools on the large—in either case, you'll find that Alcoa aluminum conduit cuts easier and faster.

Because it's easier to bend. All that's required for uniform, one-shot bends on the small sizes is an EMT bender (one size larger). You'll find, too, that mechanical and hydraulic benders work perfectly (and often faster) on all sizes of Alcoa aluminum conduit.

Because it's easier to thread. Just use sharp dies and your regular cutting oils . . . and you'll get clean, sharp threads in less time.

Because wirepulling is easy. Flexible and round tape with a terminal ball makes fishing a cinch. And wires pull easier because of Alcoa conduit's special lubricating liner.

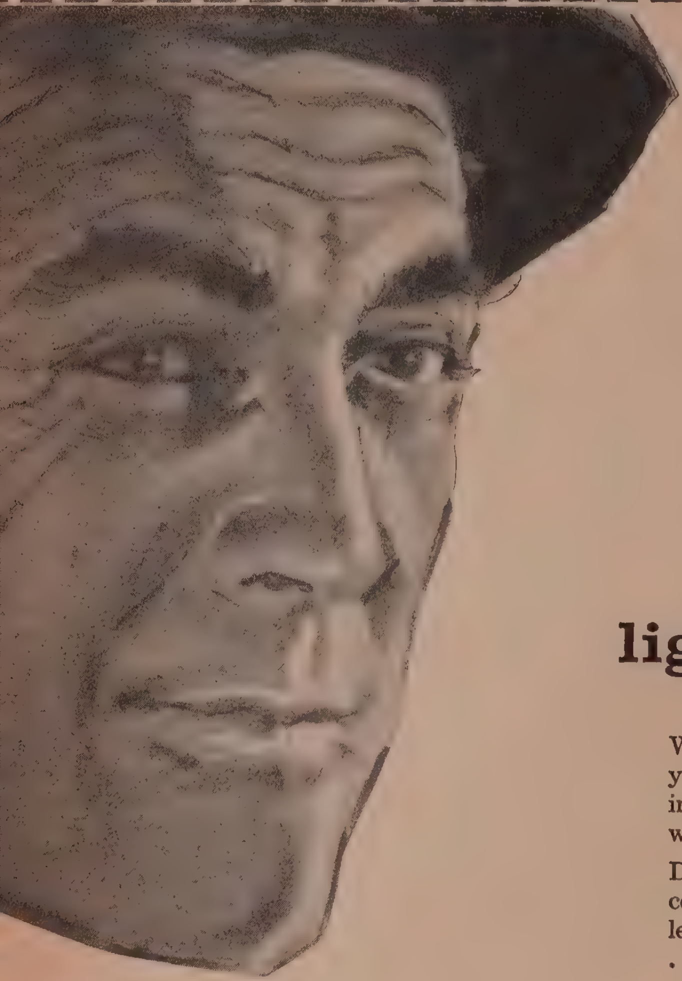
Because it's competitively priced. Compare first-price cost with that of conventional conduit and you'll see how favorably Alcoa aluminum conduit stacks up. When you consider *other* costs—cutting, bending, threading, and installing—you'll see why more contractors than ever before are switching to Alcoa aluminum rigid conduit.

Alcoa aluminum rigid conduit is sold exclusively through selected electrical distributors and wholesalers. Any one of these can give you some of the *other* reasons why you should select Alcoa conduit—corrosion resistance, long life, distinctive appearance, etc. Free literature on request . . . just drop a line to Rome Cable Division of Alcoa, Dept. 7-60, Rome, New York.

ROME CABLE
DIVISION OF **ALCOA**

JOB-PROFIT TOOLING IDEAS

FROM GREENLEE



no special attachments needed to bend ALUMINUM CONDUIT with Greenlee lightweight benders

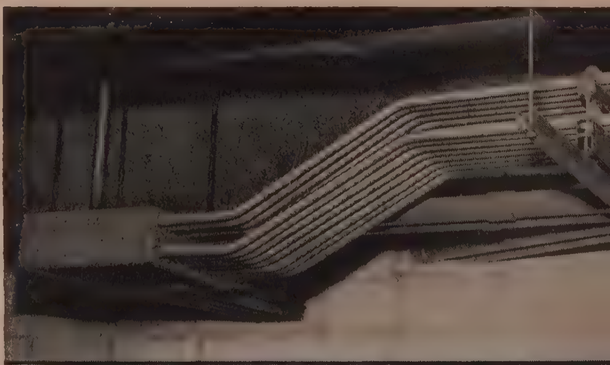
When your jobs call for bending aluminum conduit, you can streamline operations and make big savings in labor and materials with a standard Greenlee lightweight hydraulic bender.

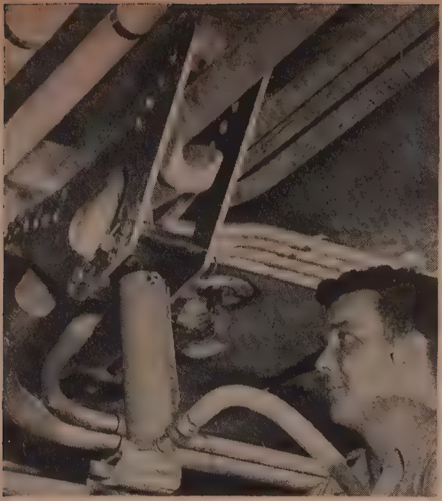
Designed to accommodate *both* steel *and* aluminum conduit and pipe without special attachments, Greenlee lightweight benders are extra rugged, fast, powerful . . . yet one man can easily transport, set up and quickly make uniform bends.

Shown at right are two views of aluminum conduit installations on a large electrical job now in progress. Top illustration shows 16 parallel runs of aluminum conduit with offsets made by a Greenlee No. 888 multipurpose hydraulic bender. Job is typical of accuracy and uniformity of duplicate bends easily made in one shot with Greenlee No. 888 benders.

Lower picture shows complex duplicate offsets and concentric bends at intersection of several conduit runs. All conduit is aluminum and *all* offsets were made with a Greenlee No. 888 multipurpose hydraulic bender . . . other bends were made with a Greenlee No. 884.

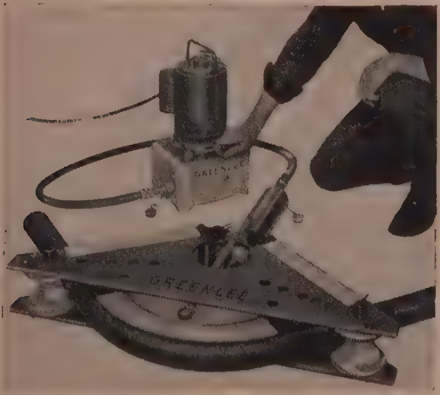
Four Job-Profit Tooling Ideas using Greenlee hydraulic benders are shown on the facing page. High-strength aluminum alloy construction of Greenlee benders holds weight to a minimum for easy portability and one-man operation.



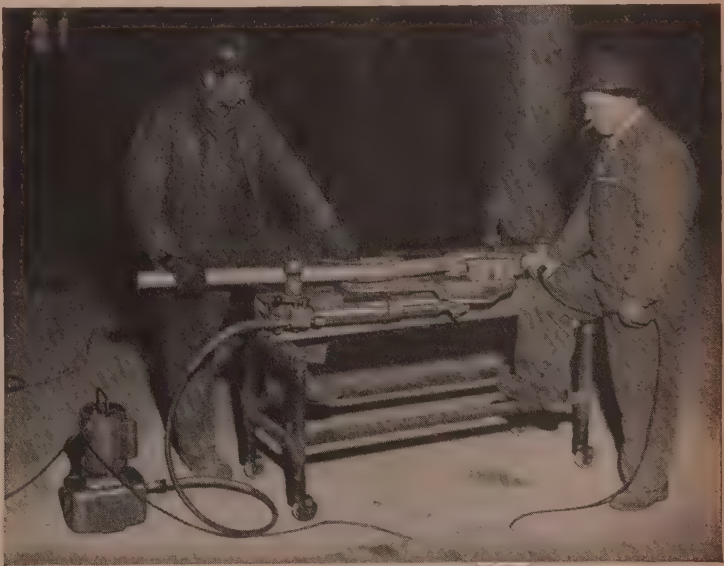


Idea for faster, more efficient bending — Cost for *all* your bending jobs can often be reduced by half or more with a Greenlee No. 880 lightweight hydraulic bender (above) for ½″ - 2″ aluminum or steel conduit. Available for hand or power pump operation, the No. 880 makes 90° bends in 2″ conduit in approximately five minutes with hand pump . . . less than a minute with a Greenlee power pump. Conduit is inserted and removed from the front . . . permits fast "in-place" bending.

Idea for streamlining bending operations on large-diameter conduit—Contractors across the country are finding big aluminum and steel conduit installation jobs are quickly completed with better results, more uniform quality when they put a Greenlee No. 884 lightweight hydraulic bender to work. Forty tons of ram pressure quickly make 90° bends in one shot in conduit ranging from ½″ - 4″. Operated with standard hand pump or Greenlee power pump.



Idea for controlling costs, making better installations — Actual on-the-job figures show that with a Greenlee No. 883 bender, costs for making bends in aluminum or steel conduit run about one third of that for using manufactured bends and fittings. Complete portability of this lightweight unit makes transportation fast and easy. The No. 883 accommodates eight sizes of conduit from ½″ - 3″ . . . requires only one size of pipe supports for complete range. Fast hand or power pump operation, plus mobility make this compact bender one of the most important tool investments you can make today.



Idea for making offsets in seconds, with one setting, one shot— When job requirements call for offset bends, make them on the job — in seconds — with a Greenlee No. 888 multipurpose hydraulic bender. Offsets always correctly aligned — no doglegs! Easily operated by one man, this bender also makes 90° bends close to the end of the pipe in one shot. For ½″ - 2″ conduit, the No. 888 features hand or power operation . . . heavy-duty casters for easy transportation.

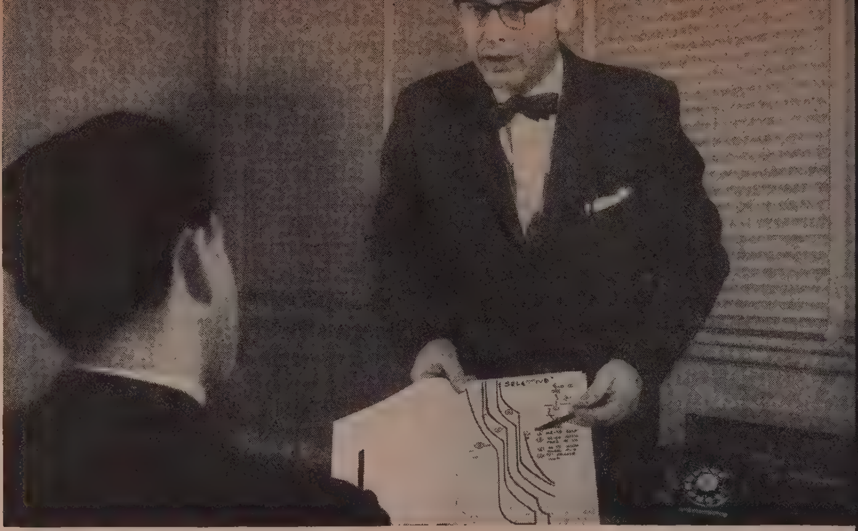
Greenlee Job-Profit Tooling offers a complete line of timesaving tools for electrical construction. Get the complete story on how they can help you to control costs, write for Bulletin E-240 today.

GREENLEE TOOL CO. 1885 Columbia Avenue, Rockford, Illinois

TOOLS FOR CRAFTSMEN
GREENLEE

JOB-PROFIT TOOLING

. . . cost control for contractors



SELECTIVITY CURVES *show tripping times for all breakers in your G-E Load Center—your assurance of SELECTIVE COORDINATION under all conditions. Ask for them.*

Selectively Coordinated Load Centers Deliver . . .

Best Service Continuity Under All Conditions

. . . Yet you pay no price premium if you buy from General Electric

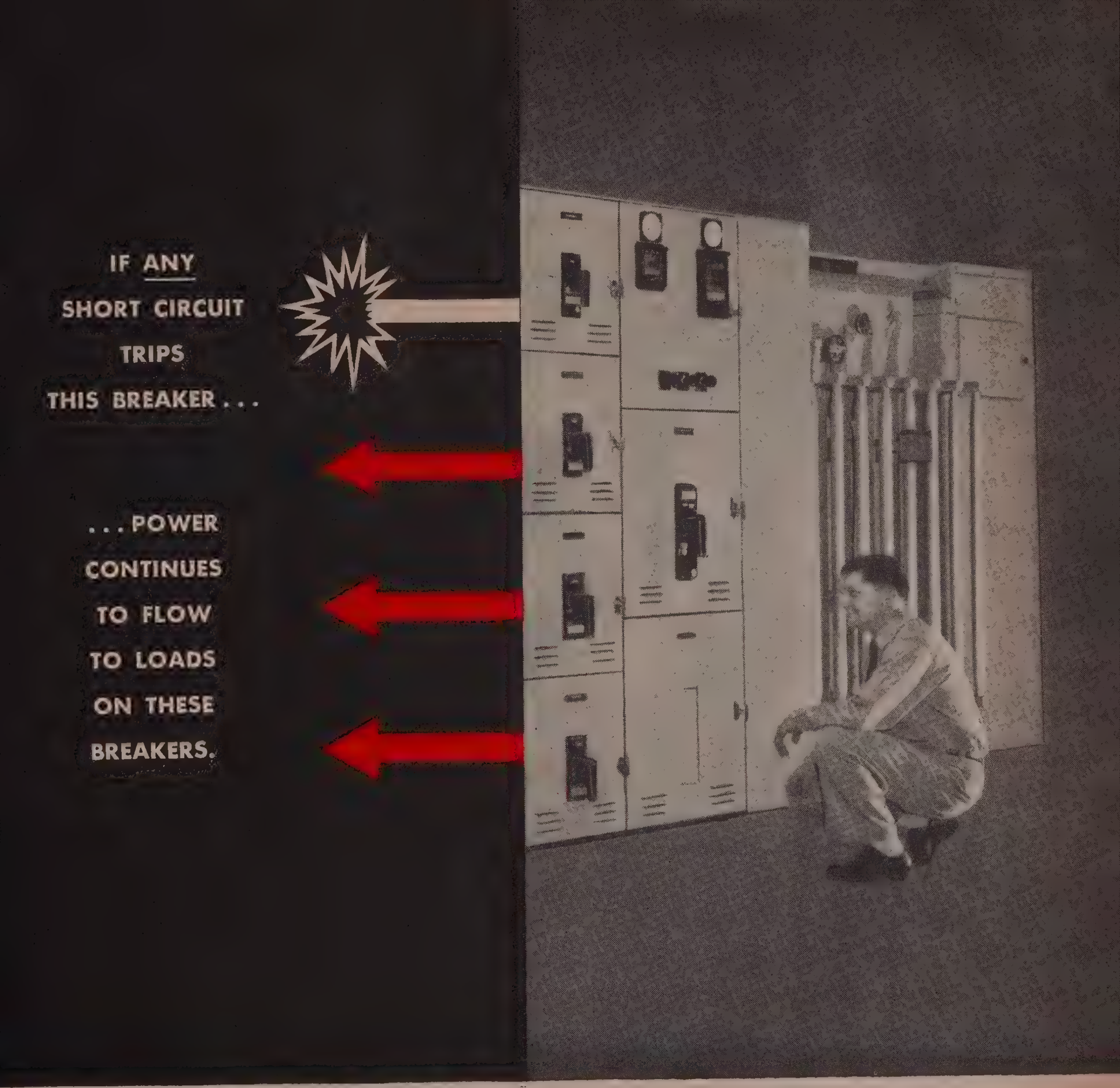
SELECTIVE COORDINATION GIVES BEST SERVICE CONTINUITY

SELECTIVELY COORDINATED Load-Center Unit Substations are your best assurance of power continuity. Power circuit breakers are factory-preset by General Electric so that—during short-circuit conditions—only the circuit breaker on the faulted feeder opens. Power continues to flow through unfaulted circuits to the rest of the loads. This "selectivity" between main and feeder breakers is accomplished by coordinating the tripping time of the main and feeder breakers.

During any magnitude of feeder short circuit, the main breaker "waits" until the feeder breaker opens.

YOURS AT LOWER COST

You now can have this superior coordination at no extra cost. Advanced engineering techniques by General Electric have eliminated the price premium normally charged for this inherently higher cost, more highly-engineered unit substation. In addition, you can save by using manually operated, stored-energy breakers in place of electrical units which were formerly required.



This means that General Electric SELECTIVELY COORDINATED load centers are now available at the same price as the fully rated load centers.

ONLY CURVES PROVE YOU HAVE SELECTIVE COORDINATION

Specify the SELECTIVELY COORDINATED Load-Center Unit Substation, with coordination curves for the specific breakers in your Load Center. These curves will show you how time-current characteristics combine to assure you of maximum power service continuity.

For more detailed information, contact your nearest General Electric Apparatus Sales Office, or write to General Electric Co., Schenectady 5, New York for publication GEA-3592.

531-02

Progress Is Our Most Important Product

GENERAL ELECTRIC

D-C CIRCUIT BREAKERS MADE IN 1928 ARE HOPELESSLY BEHIND THE TIMES

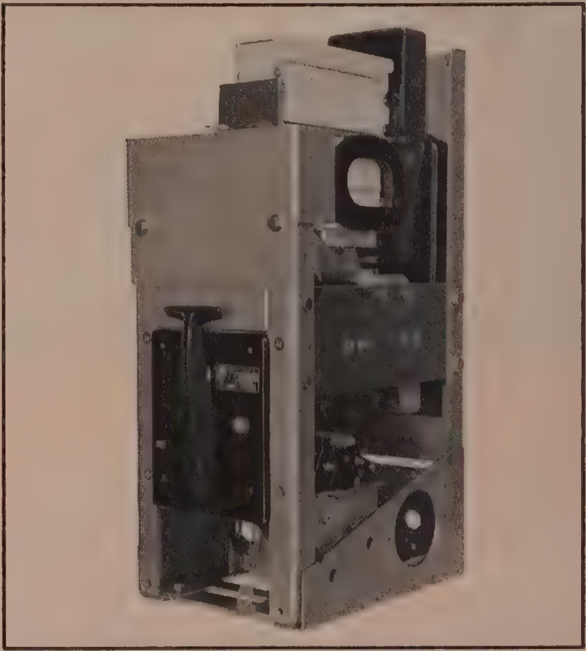
They're too slow. They can't handle the higher loads on your present circuits. They can be responsible for enormous damage to equipment in case of short circuits. And they are unsafe for personnel.

Actually there's no economy at all in trying to stretch out the life of 20 to 40-year-old d-c circuit breakers. Figure out just how much it will cost you to repair the damage to equipment alone when you have a severe overload or short circuit. Add the cost of machine downtime and you have a prohibitive expense. Probably for even less than the cost of one overload, you can install a new modern, high-speed I-T-E Model FB circuit breaker. And you will have the benefit of its superior performance for years.

The I-T-E Model FB breaker gives you current limiting action *within 6 milliseconds*. And it may be safely applied to 1000 volt d-c circuits having a rate of rise of 15 million amperes per second. Yet this high speed costs you no premium.

In addition, because the I-T-E Model FB breaker uses modern materials and techniques not available to designers of old breakers, it's much more compact and weighs many pounds less.

I-T-E Model FB d-c circuit breakers are available either 1 or 2-pole, and in capacities from 1200 through 12,000 amperes continuous. Write for Bulletin 4601-A. I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.



Model FB d-c circuit breaker, stationary single-pole, with manual stored energy closing.

I-T-E

I-T-E CIRCUIT BREAKER COMPANY

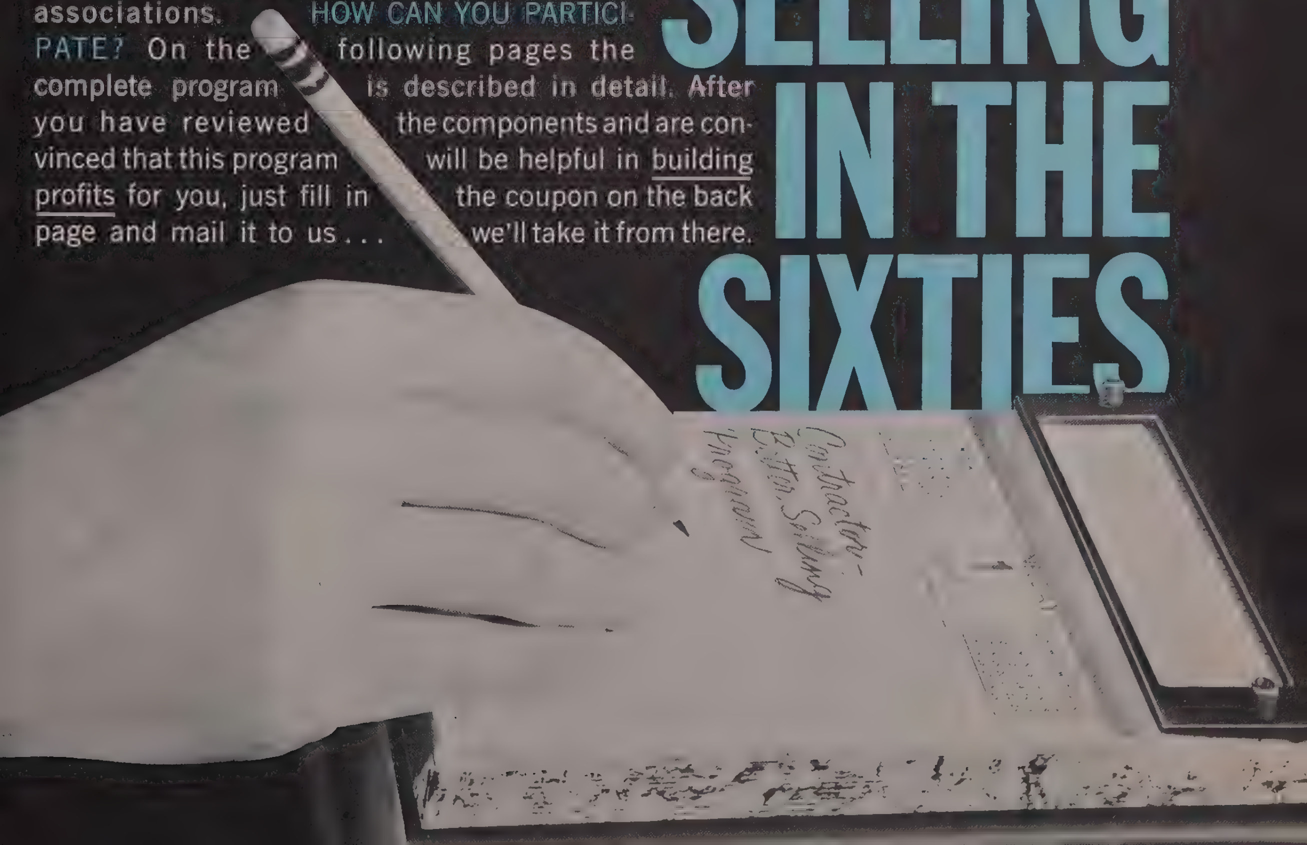
MEMO ON: THE CONTRACTOR BETTER SELLING PROGRAM

TO: ALL ELECTRICAL CONTRACTORS

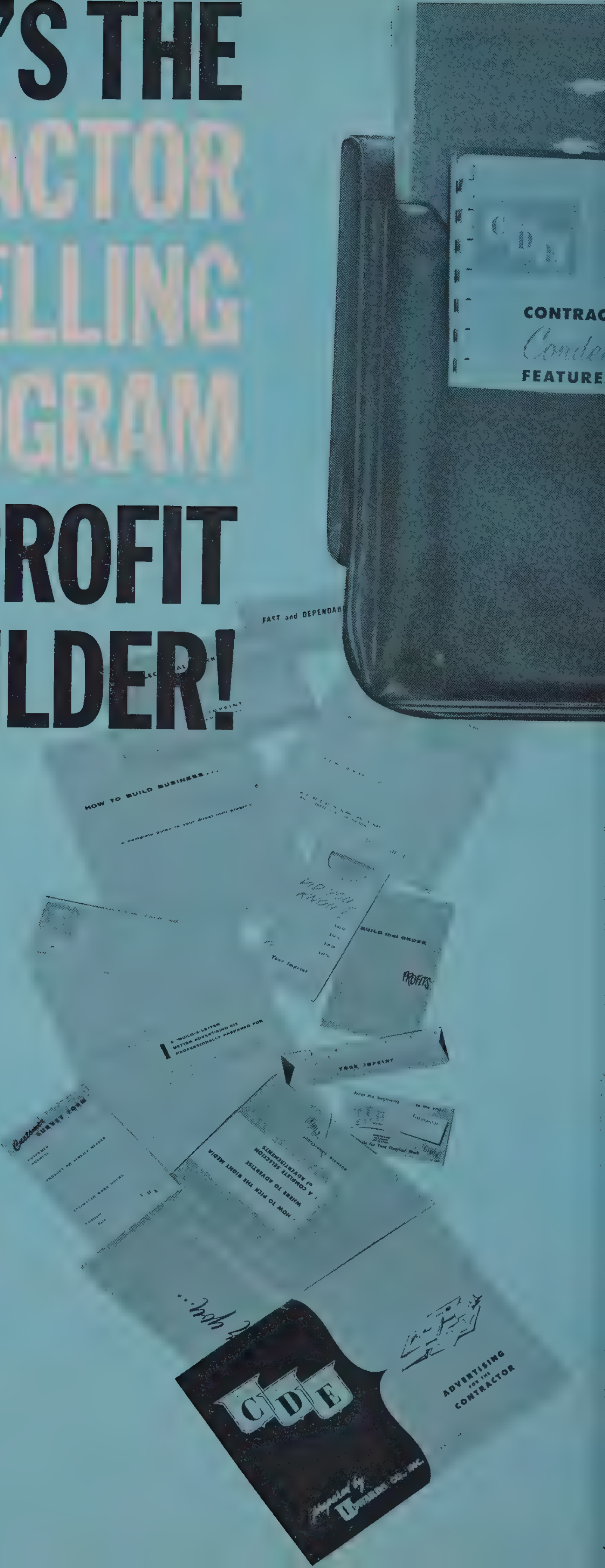
FROM: BOB KEMPTON, VICE PRESIDENT OF MARKETING, EDWARDS COMPANY, INC.

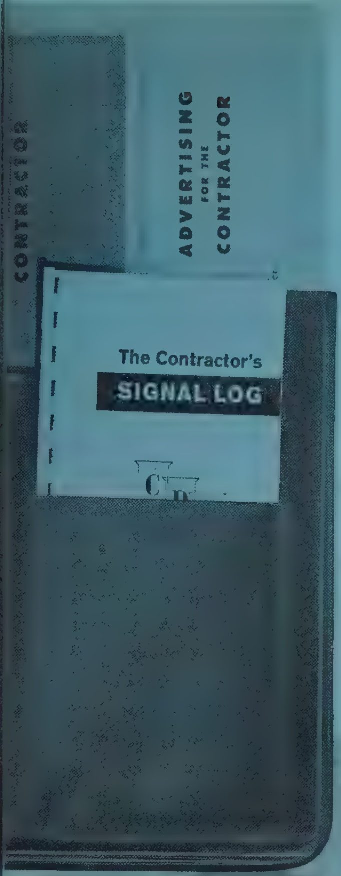
FOR BETTER SELLING IN THE SIXTIES

WHAT IS IT? A coordinated program of advertising and sales promotion aids...specifically designed to help the electrical contractor get more profitable business in all types of electrical equipment. HOW WILL IT HELP YOU? We have long considered the recognized electrical contractor who installs our equipment as an important member or our "sales team". Most electrical contractors are too busy to originate a complete sales and advertising program of their own. With the great expansion in electrical work, the contractor should direct his efforts to the most profitable jobs. This program has been endorsed by leading contractor associations. HOW CAN YOU PARTICIPATE? On the following pages the complete program is described in detail. After you have reviewed the components and are convinced that this program will be helpful in building profits for you, just fill in the coupon on the back page and mail it to us . . . we'll take it from there.

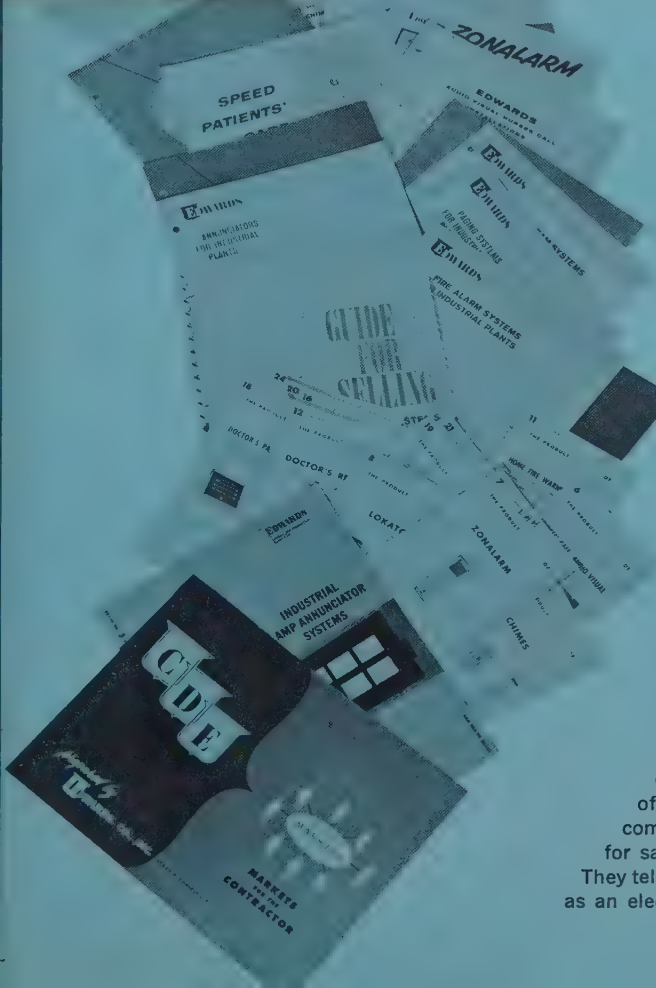


HERE'S THE CONTRACTOR BETTER SELLING PROGRAM ...YOUR PROFIT BUILDER!

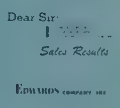

CONTRAC
FEATURE
FAST and DEPENDAB
HOW TO BUILD BUSINESS...
BUILD that ORDER
PROFITS
Your Imprint
A BUILD-A-LETTER BETTER ADVERTISING KIT PROFESSIONALLY PREPARED FOR
YOUR IMPRINT
Customer SURVEY FORM
HOW TO PICK THE RIGHT MEDIA
WHERE TO ADVERTISE
A COMPLETE SELECTION OF ADVERTISEMENTS
CDE
ADVERTISING FOR THE CONTRACTOR



A complete kit full of ideas . . . all designed to help you promote your services more profitably. From how to conduct a direct mail campaign that gets results to a clever idea for follow-up that makes new customers . . . all here to help you aggressively sell any type of electrical equipment or services you offer. **SECTION I—ADVERTISING FOR THE CONTRACTOR.** Here are 12 basic "tools" for planning a coordinated advertising or sales promotion program. Used singly or together, they can produce direct results through more profitable new work for your firm. **SECTION II—MARKETS FOR THE CONTRACTOR.** Catalogs, literature and advertising reprints; guides to the most profitable markets for electrical contracting work. **HERE ARE SOME TYPICAL PIECES IN THIS PROGRAM:**


SPEED PATIENTS'
ZONALARM
EDWARDS AUDIO VISUAL NURSES CALL INSTALLATIONS
EDWARDS ANNUNCIATORS FOR INDUSTRIAL PLANTS
EDWARDS PAGING SYSTEMS FOR INDUSTRY
EDWARDS FIRE ALARM SYSTEMS INDUSTRIAL PLANTS
GUIDE FOR SELLING
DOCTOR'S RE
LOKATOR
HOME FIRE WARN
CHIMES
INDUSTRIAL LAMP ANNUNCIATOR SYSTEMS
EDWARDS
MARKETS FOR THE CONTRACTOR

1. CONTRACTOR'S CONDENSED FEATURES KIT. A pocket-size 24 page reference guide. Shows sales features and application for all types of Edwards signaling systems and products. **2. THE EDWARDS CONTRACTOR SIGNAL LOG.** A digest of product information for industrial, residential and commercial application. **3. ADVERTISING AND HOW TO USE IT.** Your guide to advertising. A wide selection of newspaper ad mats, radio and television scripts ready for your use . . . together with a guide on how to buy space, rates and selection of media. **4. HOW TO BUILD BUSINESS USING DIRECT MAIL.** This handy reference gives you all the facts about direct mail advertising. How to build your list, postal regulations, what and how frequently it should be used for real sales results. **5. DEAR SIR (BUILD-A-LETTER KIT).** Shows you how to write your own personalized sales letters and direct mail pieces. A varied selection of attention-getting openings and closings plus complete letters that offer your services...the real benefits that outsell competition. Plus a complete assortment of pieces for salesmen's calls, follow-up and direct mail use. They tell the story of your reliability and all your services as an electrical contractor to prospects and customers.



TO APPLY FOR PARTICIPATION IN THE EDWARDS BETTER SELLING PROGRAM FILL IN AND MAIL

1 Name of Firm ____________________

Street Address ____________________

City, State ____________________

2 Please check market areas in which you are servicing key accounts regularly.

Commercial and Industrial ☐

Residential ☐

Schools and Hospitals ☐

3 Name those distributors from which you normally buy your Edwards products.

4 Do you have anyone in your organization making regular sales calls to key or prospective accounts? YES ☐ NO ☐

5 Is there someone in your organization now who could devote time to putting such a program to work? YES ☐ NO ☐

Signature ____________________ Title ____________________

EDWARDS COMPANY, INC., NORWALK, CONNECTICUT fully magnetic, competitively priced . . . and now

GUARANTEED FOR LIFE

Murray "MP" Circuit Breakers

Build Business, Profits, Prestige! Install the breaker that's best all around—best for you, best for your customers, and *Guaranteed For Life!*

You'll like working with "MP" breakers. *Fully magnetic* and unaffected by heat, these breakers never need derating, carry full rated load, never trip unnecessarily, can be installed anywhere it's most convenient for you or your customers.

Secondly, your customers will appreciate knowing that the breakers you install are *Guaranteed For Life.* It shows you're using the best, helps you get the business.

Extra Sales Aids For You! You get a special Guarantee Certificate to leave with each customer plus a special sticker for your own promotion to use on each load center. This will boost your prestige, bring extra business your way.

Here's How You Can Cash In On This Guaranteed For Life Program!

See your Murray wholesaler today for full information on this precedent-breaking promotion. Ask him also about the material he has available to help you sell builders and homeowners on Murray *Guaranteed For Life* "MP" circuit breakers. Or write Murray directly for complete details.

60

Murray

Backed By A Full Line
Of Load Centers

Murray Manufacturing Corp., 1250 Atlantic Avenue, Brooklyn 16, N.Y.

Dept. B-6

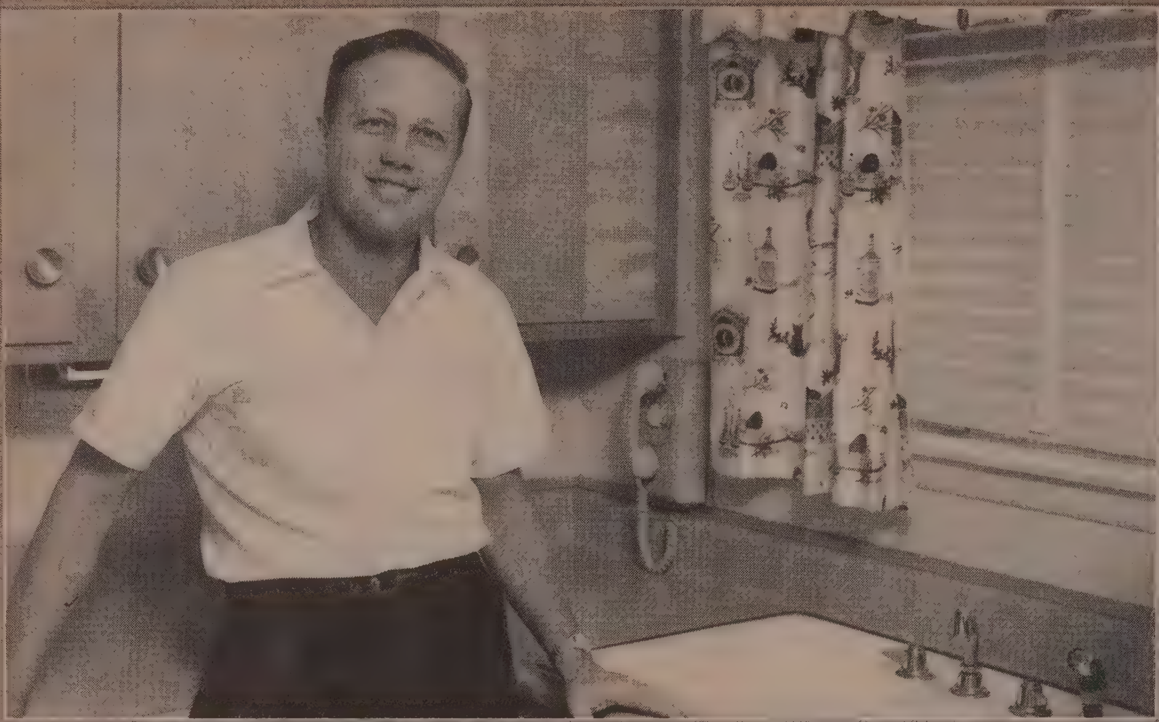
Gentlemen:

A circuit breaker that's *Guaranteed For Life!* I'm interested. As soon as possible, send me complete information on everything.

Name______________________________

Address____________________________

My wholesaler is______________________



Alden Wagner is shown in the kitchen of one of the modern Mahaffey-Wagner homes. Note the convenient wall phone.

"We've always telephone-planned our homes. We consider it a fine investment"

SAYS ALDEN WAGNER, MAHAFFEY-WAGNER CONSTRUCTION COMPANY, DALLAS, TEXAS

John Mahaffey and Alden Wagner have built 940 development homes in the Dallas area since they formed the Mahaffey-Wagner Construction Company in 1953. The homes range in price from $9900 to $18,000 and reflect contemporary, modern and early-American stylings. One thing they have in common is *concealed telephone wiring.*

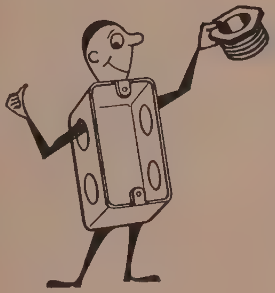
"People no longer think in terms of a one-telephone home," says John Mahaffey. "They want telephones where they *need* them—and they want them installed without exposing wires or drilling holes in the walls. We give them as many as five built-in outlets, each in a key area of the home."

Says partner Alden Wagner: "We've always telephone-planned our homes. We consider it a fine investment—a feature that tells people our homes are quality-built."

Your local Telephone Business Office will gladly help you telephone plan your homes. For details on home telephone installations, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

BELL TELEPHONE SYSTEM

NEW RACO LINE OF FITTINGS



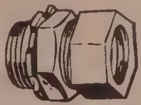
Charlie Raco has a new hat!

RACO, the complete box line, now offers you a complete line of fittings, too. There's a full line of RACO fittings for rigid conduit, E.M.T. (thinwall), armored cable, flexible metallic tubing, non-metallic cable, and service entrance cable.

And . . . the new RACO fittings are available in malleable iron, aluminum, steel, and pressure cast.

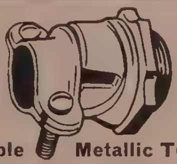
With this new addition to the RACO line, you now have a top-quality source for *all* your roughing-in materials. Your RACO Distributor has the new complete line of RACO products. Ask him about their time and money-saving features.

Rigid Conduit



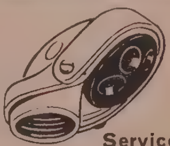
EMT (thinwall)

Armored Cable



Flexible Metallic Tubing

Non-metallic Cable



Service Entrance

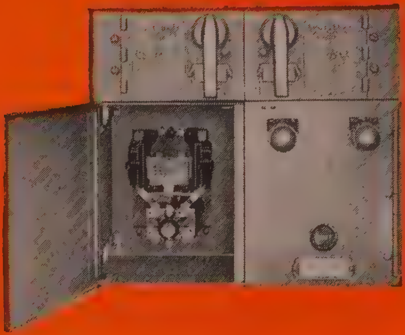
NOW RACO HAS A COMPLETE LINE OF ROUGHING-IN MATERIALS

RACO **ALL-STEEL EQUIPMENT INC.** Aurora, Illinois

NOW! FRANK ADAM

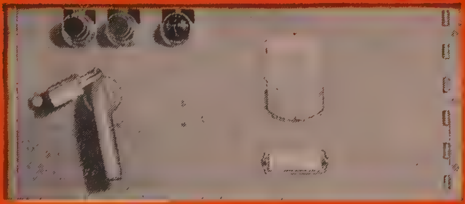
FOR FUSIBLE O

CHOICE OF TWO TYPES



NON-COMBINATION TYPE

For S-A-W Fusible Panelboards only. Twin starters with switches above, or single starter with switch above, completely assembled and wired at factory from load sides of switches to line sides of starters. One side of twin starters can be left blank for future use. Switch and starter doors mechanically interlocked; padlock feature on switch handle.



COMBINATION TYPE

For Circuit Breaker and S-A-W Fusible Panelboards. Single enclosure with either starter and switch, or starter and breaker. Wired at factory from load side of switch or breaker to line side of starter. Handles can be padlocked. Mechanical interlocked doors.

Buyer's choice of the following makes of starters: Westinghouse, Cutler-Hammer, Furnas, Allen-Bradley, Arrow Hart & Hageman.

Typical Circuit Breaker Panelboard showing 3 Combination Plug-In Starters.

Branches: 15 to 800 Amps.
Mains: 250 to 1200 Amps.

NEMA STARTER SIZES

Non-Combination Type
208-240-v. AC and 440-480-v. AC

Twin Units: Sizes 0 to 4, Non-Reversing

Single Units: Sizes 0 to 3, Reversing

Combination Type for
Fusible Panelboards
Non-Reversing only

208-240-v. & 440-480-v. AC., Sizes 0 to 3

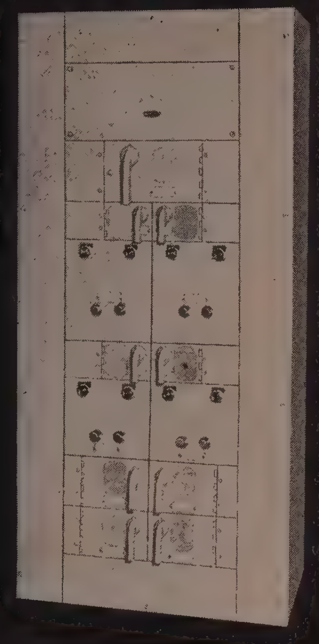
Combination Type for
Circuit Breaker Panelboards
Non-Reversing only

240-v. AC & 440-480-v. AC, Sizes 0 to 3

Write for Catalog Pages

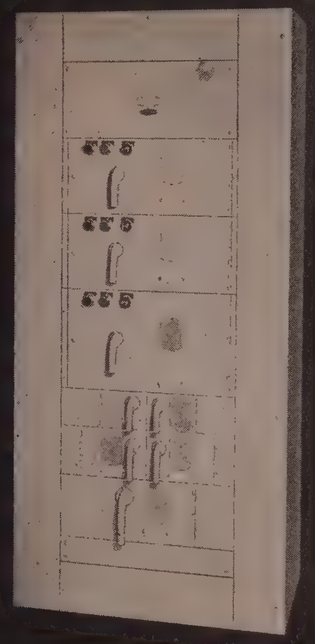
See our catalog in SWEET'S

PLUG-IN MOTOR STARTER UNITS
CIRCUIT BREAKER PANELBOARDS



Typical S-A-W Distribution Panelboard showing 2 Non-Combination Plug-In Starters.

Branches: 30 to 600 Amps.
Mains: 250 to 1000 Amps.



Typical S-A-W Distribution Panelboard showing 3 Combination Plug-in Starters.

Branches: 30 to 600 Amps.
Mains: 250 to 1000 Amps.

All in a single panelboard Plug-in starters plus plug-in switches or circuit breakers! No separate space-wasting motor controls where only a few starters are needed.

Saves money on equipment—saves space—saves time on installation. All wiring between disconnect and starter is done at the factory.

Safety interlock between starter and disconnect. Starter door cannot be opened with disconnect in "On" position.

Handle padlock feature whether starter is for circuit breaker or fusible panelboard.

Two-Coil overload relays are standard on all starters. Three-coil relays available if preferred.

Heater coils furnished without extra charge if specified on order.

Optional Accessories: START and STOP pushbuttons—ON and OFF pilot lights—extra electrical interlocks.

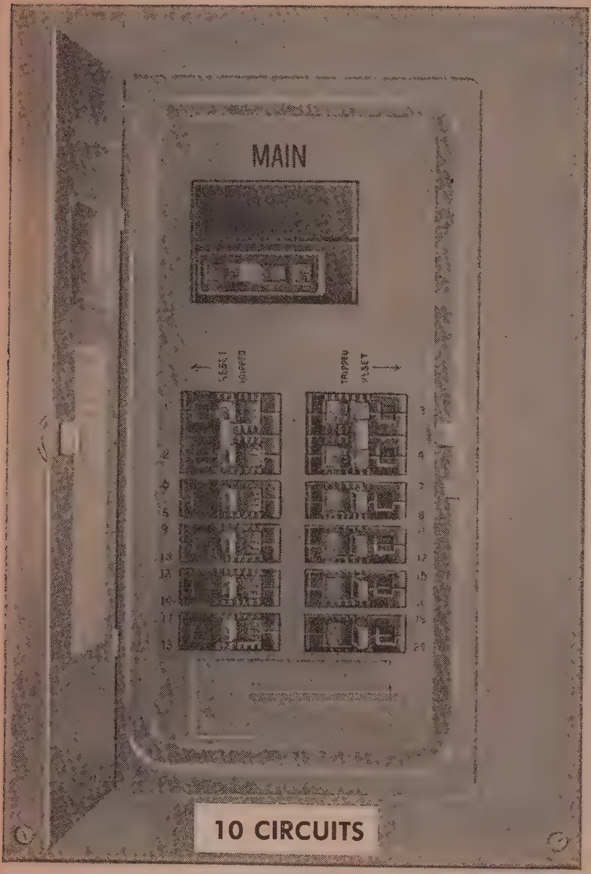
Completely assembled panelboards are available promptly from factory.

SINCE 1891

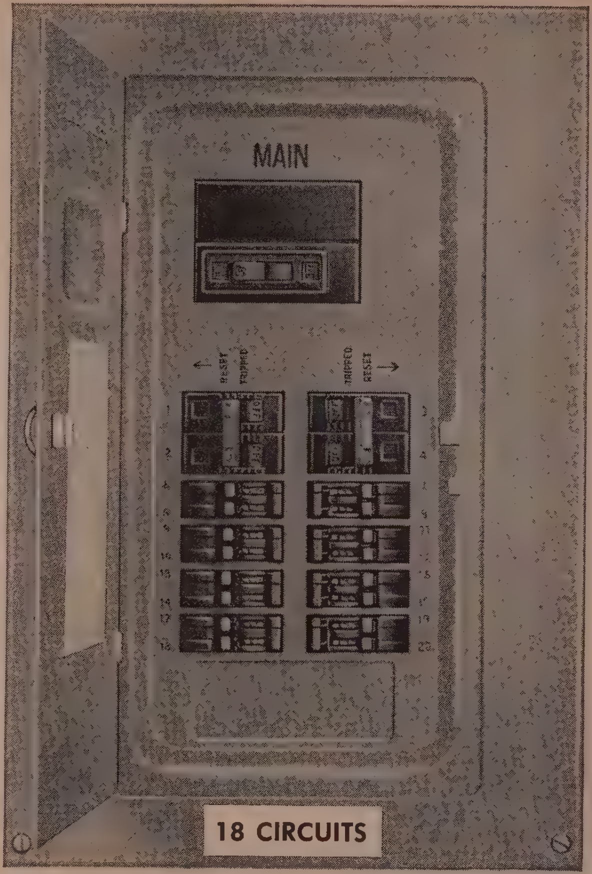
FRANK ADAM ELECTRIC COMPANY P. O. Box 357, Main P. O., St. Louis 66, Mo.

busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikheter

Same box - 8 extra circuits



General Electric TRM1210S "twin"* load center wired with two double-pole TQL plug-in breakers and eight single-pole plug-in TQL's.



Same load center wired with two double-pole TQL's and *sixteen* General Electric Type TR "twins" — two rugged breakers in a one-inch case.

Install more circuits, buy a less expensive box, with

General Electric "twin" circuit breakers

NEW

70 and 100-amp plug-in breakers

Perfect for sub-feed panels or main disconnects (back-fed). Protected female stab receptacles grip tightly; can't bend; plug-in without jiggling. All current-carrying parts silver-plated for cool, safe operation.

PROTECTING MEDALLION HOMES EQUIPPED BY GENERAL ELECTRIC

The "twin" lets you put up to twice as many circuits in the same space—because the "twin" is actually *two* rugged plug-in breakers in a single one-inch case.

Combined with other top-quality G-E breakers, the "twin" gives you complete flexibility in circuit arrangements. It is interchangeable with General Electric Type TQL single-pole and 2- and 3-pole common-trip breakers. Ask your G-E Distributor to show you how General Electric's "twin" can save you money on your next job.

*Trade-Mark

GENERAL ELECTRIC

QUALITY-SERVICE

CADWELD electrical connections rank first in both categories.

QUALITY—The connection has 100% current carrying capacity —cannot loosen or corrode and will outlast the life of the conductors.

SERVICE—Stocking CADWELD distributors are located in all major trading areas in the United States and all are continually serviced by our staff of company field engineers.

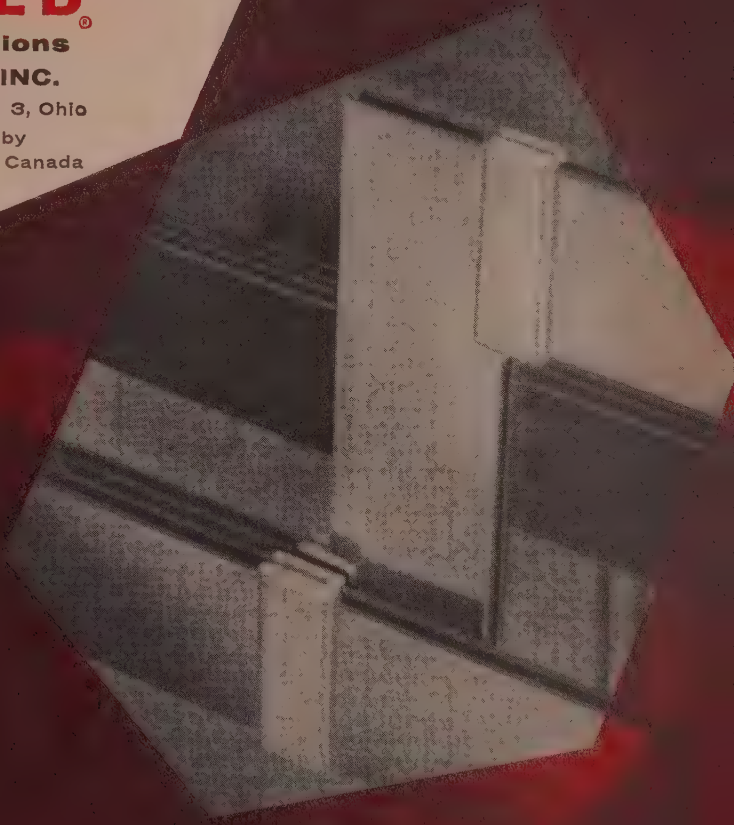
For the best in electrical connections—specify Cadweld

CADWELD®

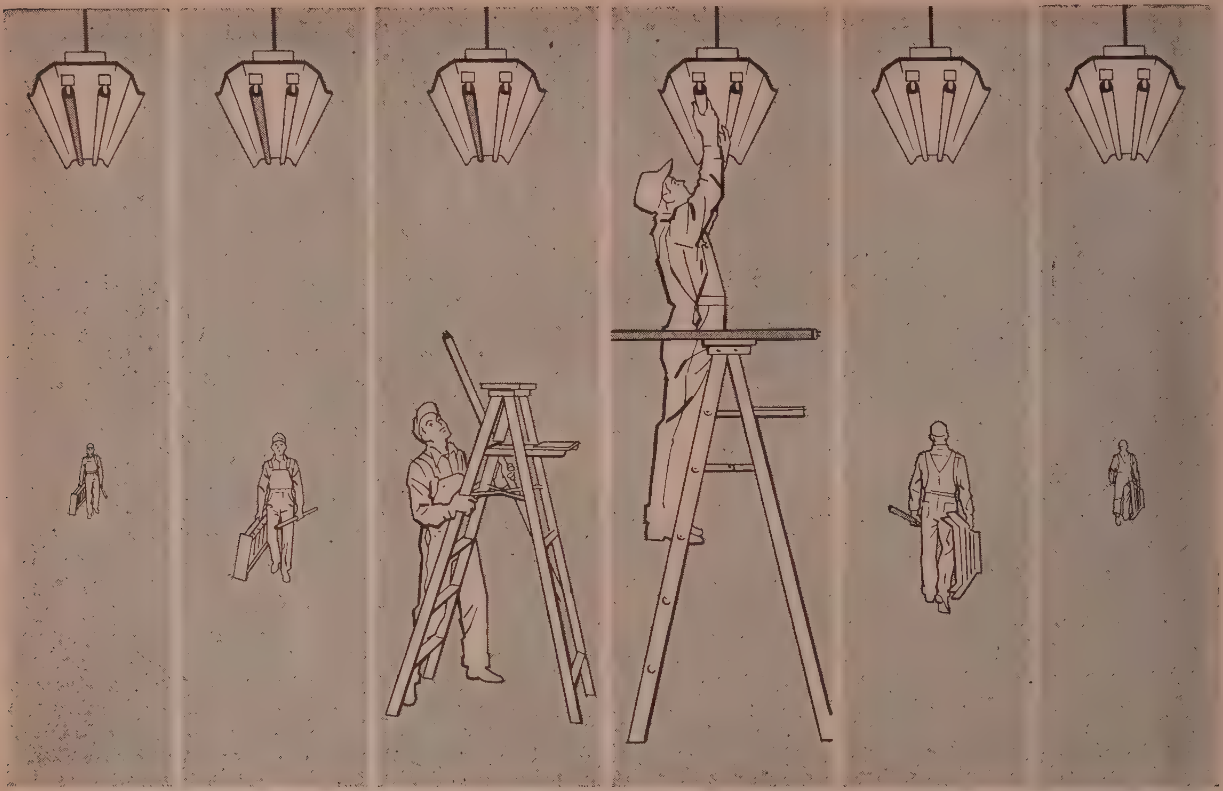
electrical connections

ERICO PRODUCTS, INC.

2070 E. 61st Place Cleveland 3, Ohio
Distributed in CANADA by
CLM Industries—Toronto 13, Canada



How long does it take him to replace one lamp?



TWENTY MINUTES! That's the average time it takes to replace one lamp. First the phone call for maintenance, then the requisition, lamp, ladder, hike to the site, lamp replacement, the walk back, disposal of old lamp, put ladder away. And work interruptions among other employees, caused by one-at-a-time lamp replacements are an expensive item not included.

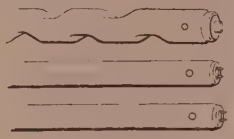
This General Electric Plan can save your customers 26 hours labor on every 100 lamps!

It takes a man about 33 hours to replace 100 lamps if he does it one-at-a-time . . . and less than 7 hours if he does it with this modern General Electric Plan for group relamping. That's a cut-and-dried savings of 26 hours for every 100 lamps your customer uses. Twenty-six times the hourly cost of one maintenance man!

But there's more! With this plan a customer also gets up to 25% more light, 75% fewer work interruptions, 75% fewer buying and stocking headaches . . . and a better looking lighting system.

Records prove this simple plan works best with General Electric Lamps. Why? Because they have a more uniform lamp life. They last most customers well over 2 years . . . with fewer early burnouts. What's more, the plan has a built-in reminder that eliminates record-keeping—tells when it's time to begin another cycle. *Right now* is the best time for you to suggest this money-saving system to each of *your* customers. General Electric Co., Large Lamp Dept. C-022, Nela Park, Cleveland 12, Ohio.

G-E LAMP UNIFORMITY MAKES GROUP RELAMPING PRACTICAL



Powerful Power Groove

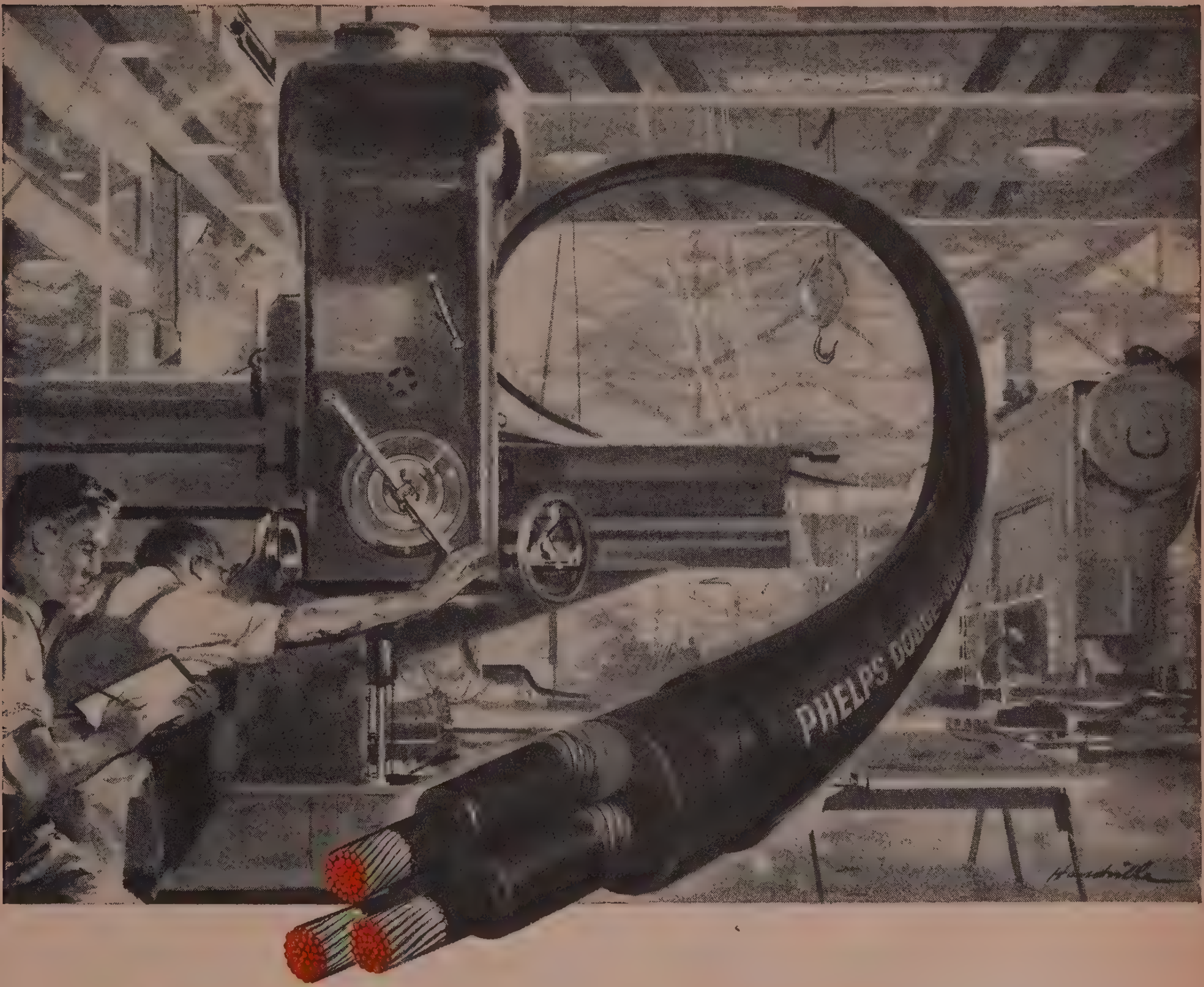
Mighty Premium 3

Economical F-40

Progress Is Our Most Important Product

GENERAL ELECTRIC

Steady plant production demands dependable power cable . . .



HABIRITE-HABIRPRENE CABLE gives unexcelled performance!

To help assure uninterrupted production, modern industrial plants require reliable cables for delivering electric power to production lines. The service reliability of Phelps Dodge *Habirite-Habirprene* is unsurpassed by any other rubber insulated neoprene jacketed type RR cable.

Habirite-Habirprene is a combination of specially engineered butyl rubber insulation and neoprene jacket. The overall features of this cable provide greater resistance to heat, oxidation and ozone; improved electrical properties, including superior insulation resistance; higher copper operating temperature; superior flexibility; improved mechanical toughness against damage from installation hazards and extra resistance to corona, an absolute necessity for high-voltage neoprene jacketed cable.

As a general purpose cable, *Habirite-Habirprene* assures the utmost in safety, durability and reliability.

See Your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS
CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N.C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D.C.

"If we had had Exide Lightguard

we would have saved many times the cost—by preventing losses from pilferage, damage and injuries in this single power failure."

Don't let it happen to you. Install Exide Lightguard.* Plug into regular outlet—it goes on automatically when lights go out. Built-in automatic charger. Batteries last for years. Choice of several models. Be protected against panic, theft, damage, personal injuries. For full details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

*Reg. TM Electric Storage Battery Co.

Exide®

Is your plant next?

If you've ever thought that this couldn't happen to your plant, a few facts may quickly change your mind. It can and *does* happen to 305 industrial plants every day! Staggering? — so are the losses, $52,260,000 worth every year.

But your plant needn't be chalked up as just another statistic! You can do something about it!

First, let's consider the cause of such large loss fires. It's a known fact that one of the main reasons small fires become blazing infernos is — *the delay in reporting the discovery of a fire or immediate notification to the local fire department.* The chart below is a grim, factual reminder of

What happens when an alarm is delayed*

Property	Minutes Delayed	Reason for Delay	Loss†
Creamery		Could not find alarm box	$75,000
Woodworking plant		Discovered by passerby	$101,000
Wire & cable plant		Employee tried to extinguish	$395,000
Ore refinery		Employee tried to extinguish	$250,000
Lumber yard		Employee tried to extinguish	$150,000
Rubber plant		Fire destroyed telephone	$100,000
Rubber warehouse		Telephone alarm, wrong address given	$55,000
Metalworking plant		No alarm system	$245,000

†Includes loss of buildings, material and equipment, but not loss of business records and other intangibles.

What you can do

Provide your plant with *complete* protection with a Gamewell FLEXALARM system that *identifies* the *zone location* of the fire, and one that can be *directly connected* with the *Municipal Fire Department*.

A FLEXALARM system can be pre-engineered to meet the precise needs of your plant. FLEXALARM is available as a coded or non-coded system, semi or completely automatic, with practically limitless possible combinations of annunciators, special drill, test and alarm features. For example, it can be tied into the municipal alarm system at the curb; integrated with the sprinkler system; or automatic fire detection devices. It's simple to specify, easy to install, efficient and economical.

Specify Gamewell . . . for maximum protection at minimum cost. Write THE GAMEWELL COMPANY, 1295 Chestnut St., Newton Upper Falls 64, Massachusetts.

*Facts on chart, itemized by The Gamewell Company, were taken from an article entitled "The Easiest Help Your Competitor Ever Got," in the May-June, 1959, issue of MODERN PLANT AND OPERATION MAINTENANCE. Reprints of this article may be obtained by filling out the coupon.

Gamewell®

FIRST...WHEN SECONDS COUNT

THE GAMEWELL COMPANY
1307 Chestnut St.
Newton Upper Falls 64, Mass.

☐ Have a Gamewell Fire Protection Engineer call.
☐ Send me a Gamewell Fire Alarm System Planning Guide.
☐ Send a reprint of article "The Easiest Help Your Competitor Ever Got."

Name...
Title...
Firm...
City..............*Zone*....*State*........

CALL ON **GESCO...**

Complete Service for

PERSONAL SERVICE . . . There is no substitute for "team effort." Regularly scheduled, personal contact by the GESCO Sales Engineer makes this possible. A single source of supply takes the "guesswork" out of procurement. Other services available through General Electric Supply Company are . . .

. . . QUICK DELIVERY 24-hour service on thousands of supply and apparatus items from stock at 185 strategically located warehouses.

Every Electrical Need

General Electric Supply Company has complete service to meet your every electrical need . . . whether it is for new construction, modernization of plant facilities or replacement of electrical equipment. And, in case of emergency, your GESCO Sales Engineer is as close as the nearest telephone. Supported by 185 completely stocked GESCO warehouses, he can provide you with every electrical requirement.

Apparatus and Lighting Specialists are ready, willing and able to solve your tough engineering problems.

Other services available to you through General Electric Supply Company are . . .

- **Complete package project service**
- **One source for all Supply, Apparatus and Lighting products**
- **Off-the-shelf service for standard and unusual items**
- **Time payment plans**
- **and . . . many other . . . call your nearest General Electric Supply Company warehouse. (See Classified Section of Telephone Directory)**

SJ-536

185 WAREHOUSES
from coast to coast

GENERAL ELECTRIC SUPPLY COMPANY

A DIVISION OF GENERAL ELECTRIC COMPANY

. . . COMPLETE PRODUCT LINE
a complete range of electrical apparatus, lamps and lighting, and all other electrical supply items.

. . . ENGINEERING AID
no job is too big or too small for the GESCO factory-trained Specialist.

FOR YOUR "FREE" GESCO ESTIMATOR

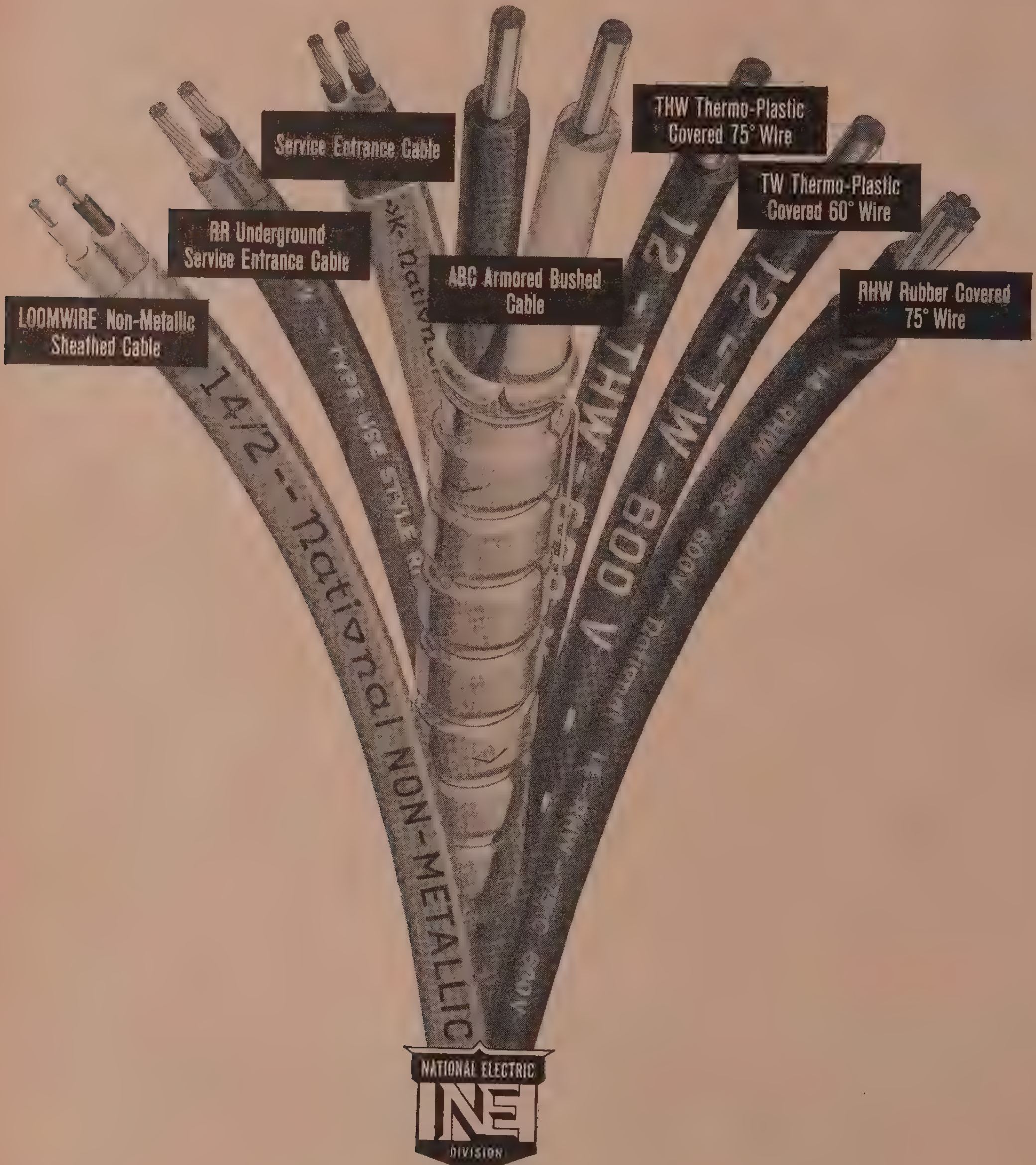
Write to:

General Electric Supply Co.
1260 Boston Avenue
Bridgeport, Connecticut

Please send me the General Electric Supply Company Estimator, a catalog giving full information and prices on products.

NAME____________________
CONCERN____________________
POSITION____________________
ADDRESS____________________
CITY______________STATE________

NATIONAL ELECTRIC ONE SOURCE FOR ALL BASIC BUILDING WIRES AND CABLES


Service Entrance Cable
RR Underground Service Entrance Cable
LOOMWIRE Non-Metallic Sheathed Cable
ABC Armored Bushed Cable
THW Thermo-Plastic Covered 75° Wire
TW Thermo-Plastic Covered 60° Wire
RHW Rubber Covered 75° Wire
14/2 -- National NON-METALLIC
TYPE USE STYLE RR
12 - THW - 600 V
12 - TW - 600 V
NATIONAL ELECTRIC
NE
DIVISION

National Electric is a single source for high quality building wires and cables of all types and sizes. On large jobs or small, you get everything that you need in one stop—with guaranteed high quality.

For complete information on the building wires and cable available from National Electric, write *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.*

NATIONAL ELECTRIC DIVISION **PORTER** ***H. K. PORTER COMPANY, INC.***

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

CHANNEL MASTER
ALUMINUM
EMT

COSTS LESS THAN STEEL!

Channel Master Aluminum EMT provides the advantages you want. It costs less to buy...looks better longer...speeds up the job!

For a price below that of steel, you can have Channel Master Aluminum EMT, the lightweight tubing that *stays* good looking ...mirror bright, mirror smooth...inside and out. Aluminum EMT won't ever show its age.

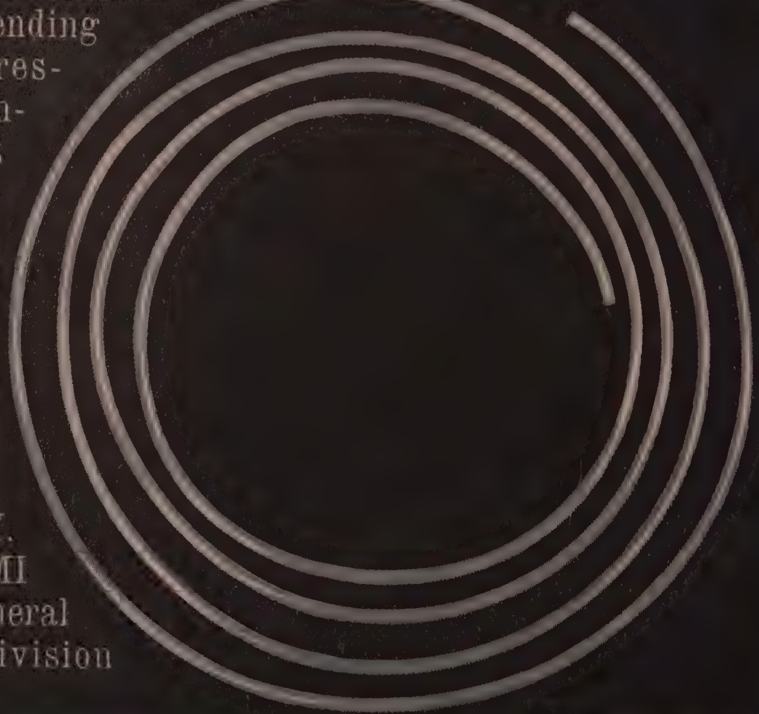
Packaged in standard 10-foot lengths, chamfered at both ends, it is also easier to cut, bend, and put together. The hard-drawn, seamless raceway facilitates fishing and wire pulling. Standard inside and outside diameters match all U.L. approved EMT fittings.

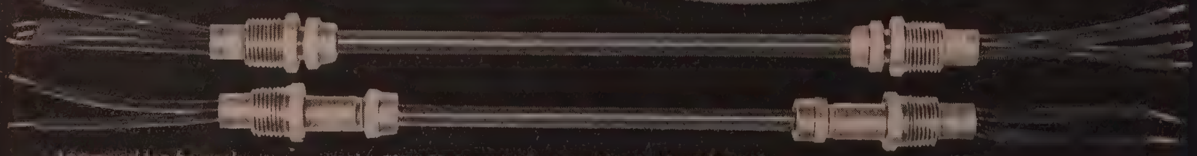
Channel Master Aluminum EMT can be purchased through your regular distributor. Ask him to show you how to make faster, better installations at lower cost.

CHANNEL MASTER CORP. ELLENVILLE, NEW YORK

Safety Mineral Insulated Cable for a greater variety of 600 v applications than any other wiring system*

MI Water Resistance: Impervious to water, steam, oils and solvents, MI is ideally suited for installations where these factors cause ordinary cables to break down. MI has helped eliminate costly shutdowns in dairies and food processing plants where washdowns are a daily function. **MI Heat Resistance:** Unlike any other cable system, the limiting factor for MI heat exposure is the copper components of the cable. The magnesium oxide insulation is heat-stable until well over twice the melting point of copper (1083C). With an MI system as opposed to conduit there is no need for circuitous routing to avoid contact with boilers, machines and other sources of heat. Cable operating temperature is 250C, but standard general application (Type O) and hazardous areas (Type H) seals are limited to 85C. **MI Flexibility:** No need for factory-made conduit bends...MI can be hand formed on the job and easily clipped into position. MI is able to withstand severe twisting, bending and deforming pressures because the conductors cannot shift within the highly compressed magnesium oxide insulation. For a copy of our new MI catalog, write **General Cable Corporation,** 730 Third Avenue, New York 17, N.Y. Manufacturers of MI Cable since 1941. Mineral Insulated Cable Division





Approved for hazardous areas in the 1959 National Electrical Code, Articles 330, 501, 502 and 503.

FREE—$50 IN REMCON DEVICES!

Builders, architects, homeowners—today *everyone* is looking for the little touches of luxury that make a home more desirable, more saleable. Low-voltage switching is just the "extra" that can help you provide *your customers* with comfort and convenience through electricity. And now with REMCON, the low-voltage system that's practical in any home regardless of cost, you can do it at a profit!

WHAT IS LOW-VOLTAGE SWITCHING?

Low-voltage switching is the greatest advance in light control since the pull chain. By eliminating the need for elaborate, costly wiring, it provides the ultimate in versatility and safety through multi-point, master-control and path-of-light switching. Low voltage switching also ends shock hazard by putting only 6 volts at the switch.

4 REASONS WHY REMCON IS EASIER TO INSTALL

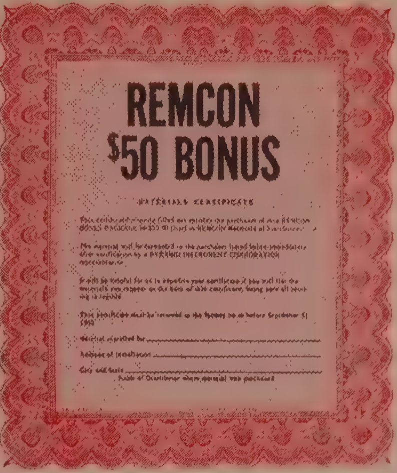
REMCON builds the transformer *right into the relay* to make low-voltage switching easier four ways: 1. No separate low-voltage source (eliminates additional wiring); 2. No complicated systems. With REMCON, installation is as simple as connecting the three wires of the relay to the three color-coded wires of the switch; 3. No more need to run heavy armored cable from fixture to switch; in fact...4. No more switch box! Any way you look at it, there's no longer any reason to shy away from modern low-voltage wiring—especially when you think of the time, labor and money it saves!

THOUSANDS OF DELIGHTED USERS

Contractors everywhere are delighted with REMCON'S flexibility, whether they wire tract or custom homes. Read these:

"Remcon helps me provide luxury at a profit even in a $15,000 home. I can build in three- and four-way switching quickly—*at lower labor costs*—because Remcon's #18 wire *staples* to studs. I'm sold, and my tracts go just as fast." *Sidney Gotowner, Gotowner Electric.*

"Even in a custom home, small details like Remcon's pilot-light switches and hi-fashion switch plates are appreciated. Remcon plates, for example, blend with and enhance any room's decor. They're practical in *any* home." *Ephraim Berkowitz, Turnpike Electric.*



REMCON
$50 BONUS

MATERIALS CERTIFICATE

NOW ACTUALLY COSTS LESS!

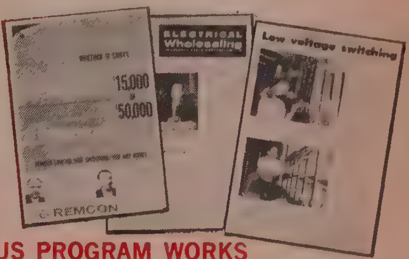
Before this $50 Bonus Program, the ease of installing REMCON was more than enough to offset the slight expense over outmoded, conventional wiring. But even that's been changed. Now REMCON gives you a Certificate worth $50 in the REMCON devices of your choice—just for trying REMCON on your next job.

REMCON SUPPORTS YOUR SELLING EFFORTS

To make it still easier for you to sell, REMCON is now in the midst of an extensive advertising and promotion campaign which includes full-page colorful ads, direct mailings to builders and architects, and an intensive publicity effort that has paid dividends in a steady barrage of articles in leading newspapers and magazines.

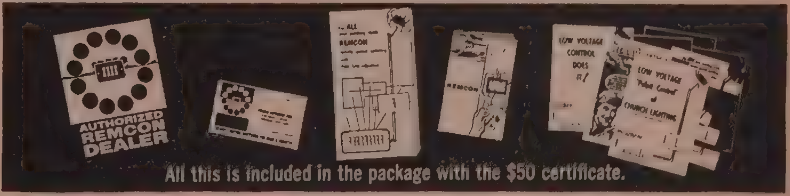
REMCON—THE ANSWER TO CUTTHROAT COMPETITION

The need for contractors to "trade up" their customers is so important today that the National Electrical Contractors' Association made it the prime topic of discussion at their recent convention. How do *you* break out of the vicious circle of low bids, cheap services, poor or no profits? By offering the "plus" that pulls you away from the pack...REMCON!



HOW THE $50 BONUS PROGRAM WORKS

Go to your distributor. Buy your first package of REMCON materials (it's enough to wire the average three-bedroom house). This package will also contain: 1. A *Materials Certificate* worth $50 (list) in the REMCON materials of your choice; 2. A request form for obtaining free business cards imprinted with your name; 3. Free envelope stuffers for you to distribute to your customers; 4. Free truck decals; 5. Complete REMCON literature, including an Electrician's Manual, an illustrated instruction manual, easy-to-follow installation data sheets and wiring diagrams, and articles describing typical industrial and residential REMCON installations. You also get all new information as soon as it's issued. In addition, you will automatically be listed as an *Authorized* REMCON *Dealer*, which entitles you to our free Consultation Service—you send us your prints and we'll send back a REMCON switch layout and a list of the materials needed to do the job. The $50 Bonus Program is now in effect. Go to your distributor today!


AUTHORIZED REMCON DEALER
REMCON
LOW VOLTAGE CONTROL DOES IT!
Low Voltage Pilot Control of Church Lighting

All this is included in the package with the $50 certificate.

REMCON A Division of Pyramid Instrument Corp.,
630 Merrick Road, Lynbrook, N. Y., Dept. EC-60

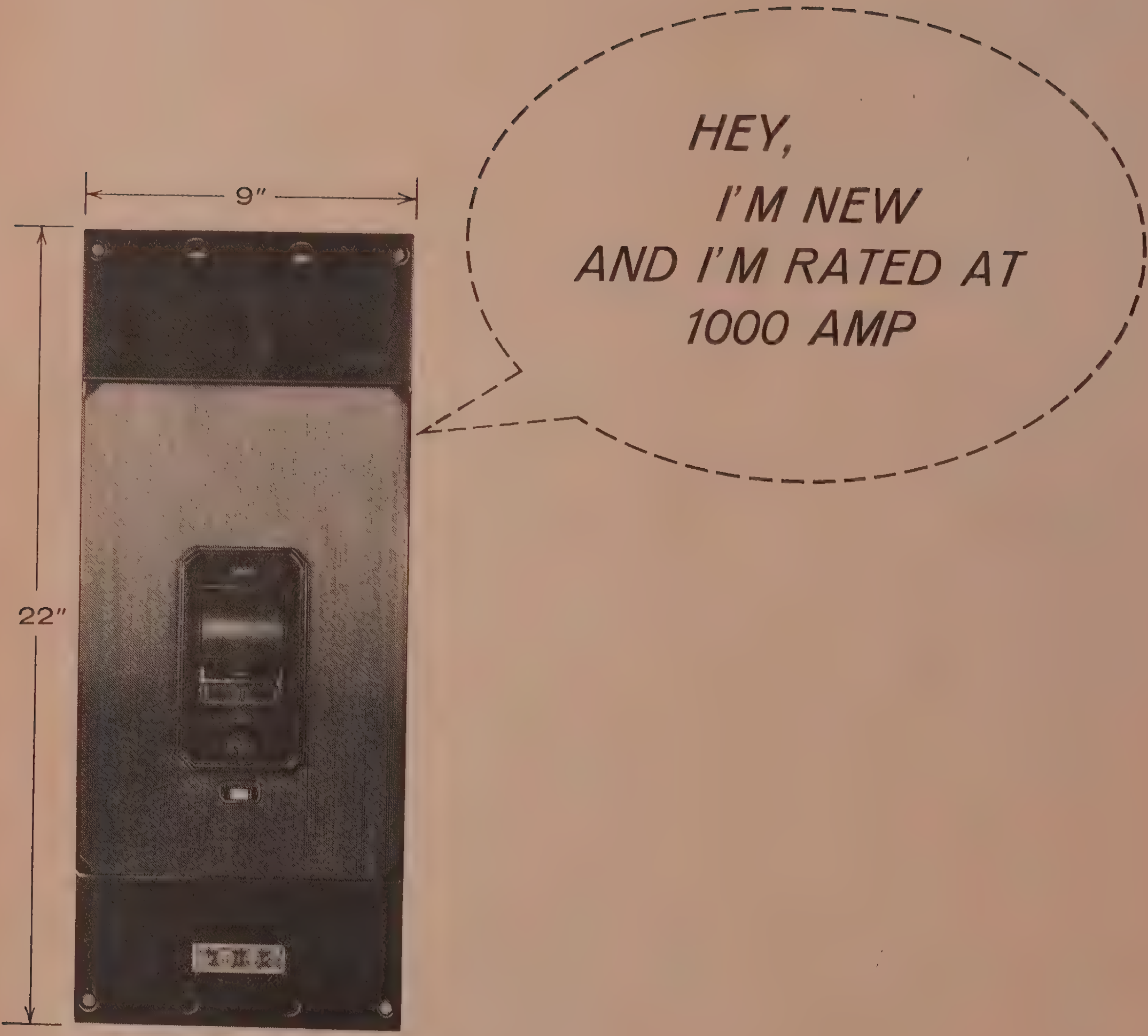
Okay REMCON, sign me up as an Authorized REMCON Dealer, send me your *free Information Kit* and the name of my local REMCON Distributor. I understand I am under no obligation.

Name______________________________

Address______________________________

City______________Zone_____State______________

MAIL NOW



I-T-E introduces the new MN frame molded case circuit breaker. Same dimensions as former 800 amp breaker. Rated at 1000 amp continuous, interrupts 50,000 amp at 240 volts, 25,000 amp at 600 volts. Send for all the details. Write I-T-E Circuit Breaker Company, Dept. SA, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

INTRODUCING...

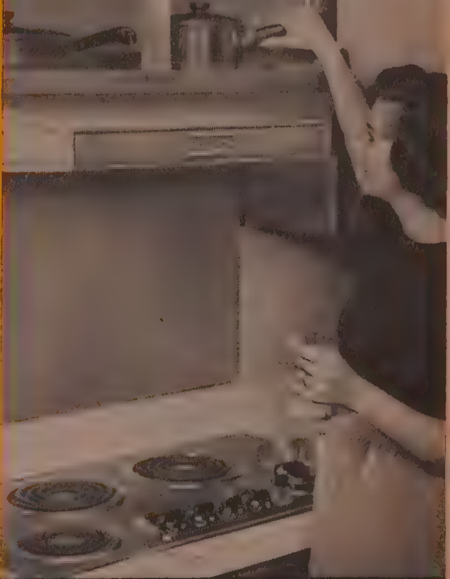
THE NEW Broan MIXED-FLO RANGE HOOD

It combines the performance you want with the price that you like.

Two important advantages come your way with this new contract winning hood. Both of them help make your bid look best.

Advantage No. 1 is a hood of superior performance. With the Mixed-Flo Fan you can point to an exhaust system that is revolutionary in development . . . that performs more efficiently, runs more quietly than any fan or blower-operated hood on the market.

Advantage No. 2 is cost. You can bid low with the Mixed-Flo because you have an initial price advantage. And you save valuable time and money on every job because this great hood, like all Broan hoods, comes to you as a complete package, factory wired, fully assembled, ready to mount in place. And the Mixed-Flo is engineered to fit your installation with either vertical or horizontal discharge.



MIXED-FLO HOOD FEATURES—

- Unitized Construction — the fan is fully housed within the hood. There is no lost cabinet space whatever.
- Great In Exhaust Power — the new Mixed-Flo Fan provides extra pressure needed for long duct runs and elbows . . . formerly achieved only by blower powered units.
- Remarkably Quiet In Operation — the highly efficient Mixed-Flo Fan is designed for low sound level performance.
- Smooth Inside, Outside Construction — no sharp screw ends.
- Smart Sculptured Hood Design — only 5 slim inches high. Mitered corners permit cabinet doors to open fully.
- Equipped for Twin Lights for shadowless cooking. Recessed lifetime aluminum filters snap out with the greatest of ease. Front pushbutton controls.
- Accommodation For Vertical Or Horizontal Discharge to 3¼" x 10" duct without fittings.
- A Fast Running Installation — comes prewired, preassembled . . . simply remove the outlet box cover to hook up power supply.

See your wholesaler or write for full information

Broan MANUFACTURING CO., INC. • 948 W. STATE ST., HARTFORD, WIS.
(Near Milwaukee)
Specialists in Quality Ventilating Equipment for Over 25 Years

In Canada — Manufactured by Superior Electrics Ltd. Pembroke, Ontario

KAISER ALUMINUM

$ COSTS NO MORE TO BUY

and offers complete assurance

Contractors everywhere are finding that the old ways aren't necessarily the best ways when it comes to buying and installing rigid conduit. The big money-saver is aluminum . . . for good reasons.

1 Low Initial Cost.

Today, aluminum conduit costs no more than steel . . . an important factor to consider when figuring your bid.

2 Lower Installed Cost.

Aluminum conduit weighs only *one-third as much* as the same size steel conduit. Result: easier handling . . . less worker fatigue . . . easier cutting, threading, bending . . . faster, more economical installation.

3 Lower Maintenance Costs.

Because aluminum conduit can't rust and is highly corrosion resistant, maintenance and replacement costs are virtually eliminated. Aluminum never needs painting, keeps its look of quality for years. Other quality features: aluminum conduit is non-magnetic, which reduces voltage drop; non-sparking for safe use in hazardous areas; and non-toxic for safe use in food processing plants.

Your Kaiser Aluminum Electrical Distributor can save you money now!

The man to see before you bid another job is your Kaiser Aluminum Electrical Distributor. Compare prices—see how Kaiser Aluminum rigid conduit can give you the competitive edge on any contract.

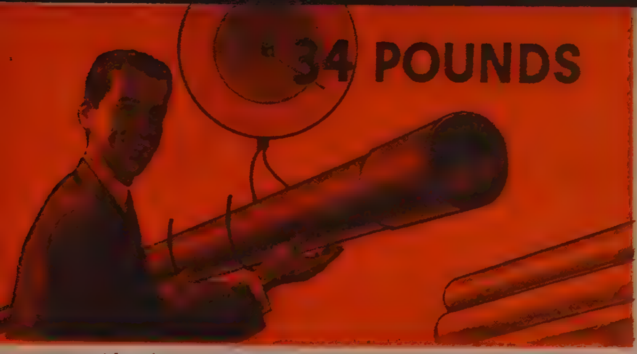
Your Kaiser Aluminum distributor has a complete stock of aluminum conduit sizes and fittings—as well as money-saving aluminum wire and cable—ready for immediate delivery to your job site.

See or call him today. Ask for a free copy of the *Kaiser Aluminum Rigid Conduit Brochure* containing comparative weights, installation details, and all the facts you need to lower your costs.

RIGID CONDUIT

$ COSTS LESS TO INSTALL

of a quality installation!



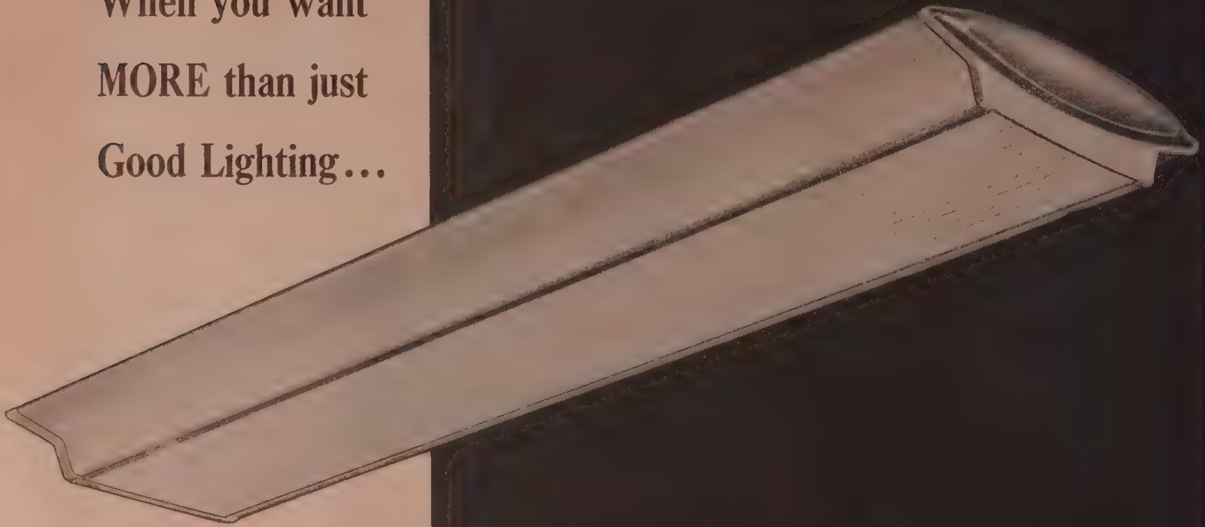
Aluminum conduit is easier and safer to handle. A 10-ft. section of 4-inch aluminum conduit weighs only 34 lbs.; steel—98 lbs.

Aluminum conduit can't rust, is highly resistant to corrosion. Your aluminum conduit installation gives years of low-maintenance service.

Aluminum conduit is easier to work with than steel conduit. Easier handling saves you time, labor and money.

KAISER ALUMINUM

Kaiser Aluminum & Chemical Sales, Inc.
Kaiser Center, 300 Lakeside Drive
Oakland 12, California



When you want
MORE than just
Good Lighting . . .

You want

Sylvania's CLASSIC

Series

Every Classic Fixture
*Now Produced***
Contains the New Solid-Fill
Jefferson DRI-LOK *Ballast!*
**in standard voltage

"Fluorescent lighting fixtures today must do more than provide good illumination. They must also add a distinct element of attractiveness to the ceiling to complement the overall interior décor."

With this concept in mind, Sylvania's Engineering Department, working together with the renowned industrial designing firm of Peter Muller-Munk Associates, created a new fixture family that is truly outstanding.

This is the CLASSIC Series by Sylvania.

The CLASSIC achieves, through its pointed elliptical shape, the elegance and style demanded by today's leading design concepts. This new fixture group features sleek, trim lines; flared, softly-diffusing side panels; and slim shallowness . . . all of which combine to provide a graceful appearance for any interior. To satisfy individual choice, plastic louvers or plastic panels are available.

And the practical aspect has not been ignored either. In addition to its extreme attractiveness, the CLASSIC also provides other important features . . . high-quality lighting characteristics and excellent installation and maintenance advantages.

But a mere description of the CLASSIC is hardly adequate. To appreciate the true beauty and application possibilities of this series you should see the fixture itself.

Write for full information today . . . and ask to have the CLASSIC* demonstrated in your own office.

Sylvania Lighting Products
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia

*Patent Pending

GO MODERN WITH LIGHTING BY SYLVANIA

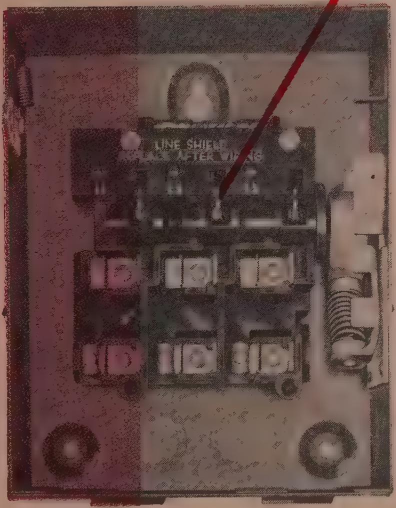
Subsidiary of GENERAL TELEPHONE & ELECTRONICS

FLUORESCENT LIGHTING FIXTURES AND SYSTEMS • BEST FIXTURE VALUE IN EVERY PRICE RANGE

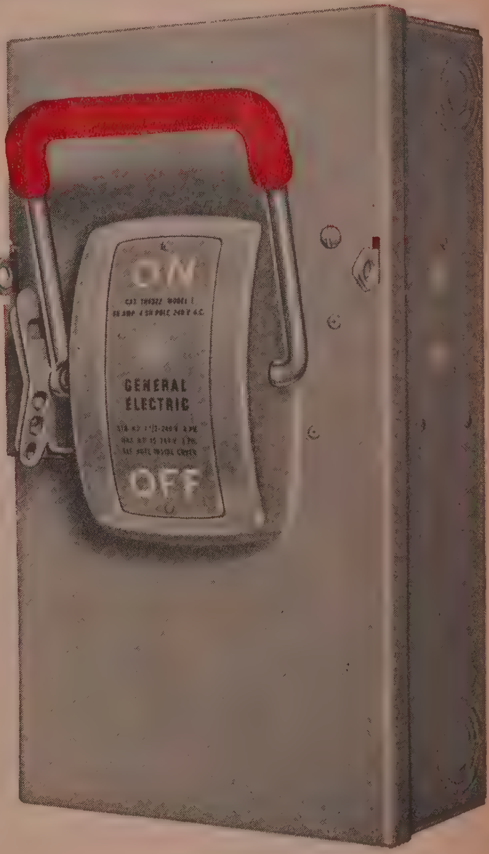
For extra safety...

GET THE SWITCH WITH THE RED HANDLE!

You can see the contacts— Silverplated blades are plainly visible, spring reinforced for full, firm electrical contact.



No wire abrasion
Side wiring gutter is unobstructed—free of moving parts which can chafe and wear wire insulation.



These features mean extra safety for you: Vivid red handle is insulated, provides ON-OFF identification from over 100 feet away; safety phase barrier protects against accidental contact with live parts; no fiber linkages in mechanism to deteriorate with age, moisture or heat; complete locking provision; mechanical interlock and line shield (Heavy Duty). Heavy Duty (Type A) sell at Normal Duty (Type C) price levels. Write for Bulletin CPD-74. See your G-E distributor for a demonstration.

GENERAL ELECTRIC

Circuit Protective Devices Dept., Plainville, Conn.

WAGNER TRANSFORMERS

RIDE OL' MAN RIVER

Out in the channel, that's Federal Barge Lines' M.V. UNITED STATES. Designed and built by St. Louis Shipbuilding & Steel Co., she's the most powerful towboat on America's inland waterways. Headed up the Mississippi, this 8,500 horsepower giant pushes a record-breaking 42 barges, the equivalent of seven and one half acres. The boat is designed to push 40,000 tons of cargo, the capacity of a freight train 1,000 cars long.

You'll find seven Wagner Dry-Type General Purpose Transformers on duty aboard the UNITED STATES. Six 10 Kva and one 7½ Kva transformers (all 480 volt primary, 120/240 volt secondary, with 2 extra primary taps) are used to power this muscled lady's lighting system, small motors, and most of her navigation equipment.

Ashore or afloat, Wagner Type AE Transformers can be used for all general purpose applications, including those where noise must be minimized. They have a low sound level, the result of encasing smaller Form W core and coils in solid epoxy compound... give you a whisper-quiet transformer that can be used anywhere noise would be a nuisance.

Wagner Type AE Transformers have insulation protection suitable for continuous operation at 80°C in a 40°C ambient. All parts are sealed from dust, moisture, and corrosion by the epoxy compound. Naturally, every unit is built to conform to all applicable standards of ASA and NEMA.

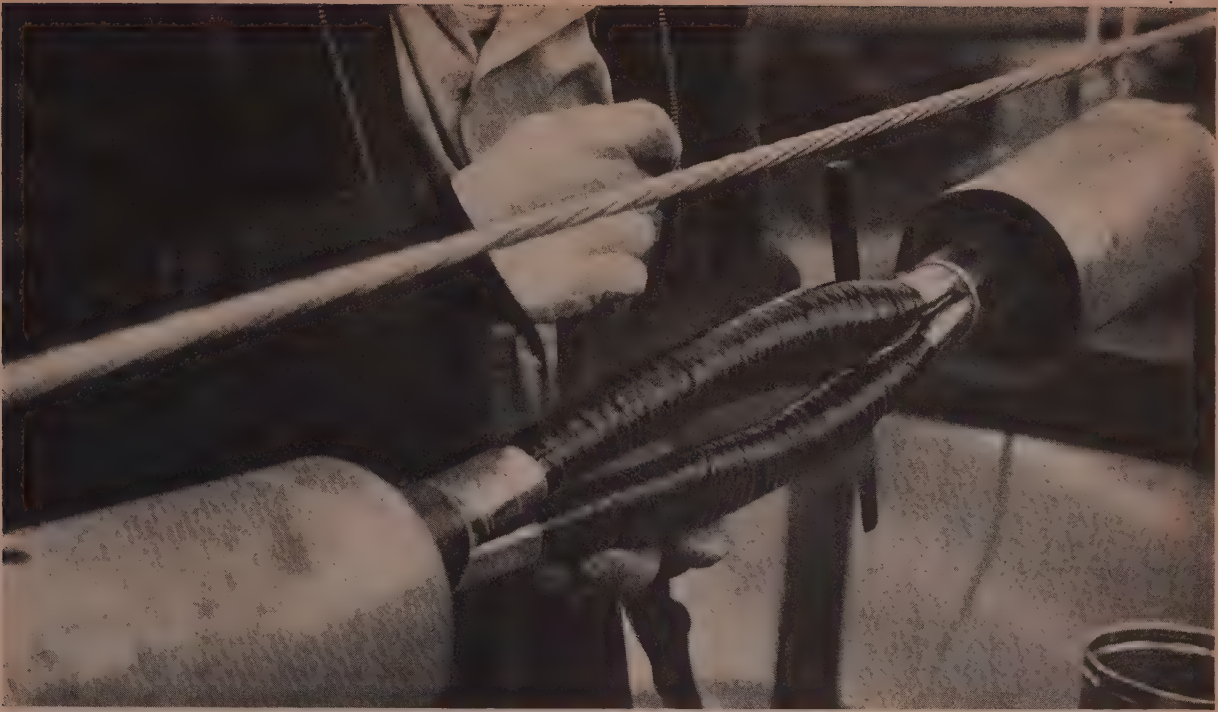
Wagner Type AE Transformers can be installed indoors or out... anywhere they will not be submerged or exposed to injurious fumes in concentration. Compact and lightweight, they can be mounted in any position at any angle, on walls, floors, or ceilings.

Like to know more? Wagner branches and distributors have all the details. There's one near you, listed in your 'phone book. Call or write. Soon.

WT60-13

Wagner Electric Corporation

6413 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI



RUGGED YEARS AHEAD . . .

that's why the job demands SLIPKNOT

Whether you're splicing transmission lines or residential outlets, every splice you make must be final, safe and *permanent*. You can't afford any tape but the *best* . . . and the best costs no more. SLIPKNOT PLASTIC ELECTRICAL TAPE is the choice of the country's most experienced electricians, because it *handles easily*, *conforms readily*, and *snugs* and *stays down*.

With adhesive permanently anchored to vinyl base, with controlled tension for proper stretch without dangerous thinning — with absolute conformity, roll after perfect roll — no wonder SLIPKNOT is the specified tape. The patented cutter, packed free with every 66-foot roll, speeds the job and saves you money.

Find out why SLIPKNOT is found in all the best splices. Try a roll today.

TAPES BY
SOLD ONLY
THRU
RECOGNIZED
DISTRIBUTORS
PLYMOUTH RUBBER COMPANY, INC.

PLYMOUTH RUBBER COMPANY, INC.

QUALITY SINCE 1896 *Makers of* SLIPKNOT FRICTION TAPE — *most widely used in the world* CANTON, MASSACHUSETTS

New G&W "Off-the-shelf" shipping system

means faster deliveries; reduced installation costs on potheads and oil fuse cutouts!

Orders received in the morning at G&W are often on their way to you the same afternoon. There's no time wasted in getting standard G&W Capnut and Sodertite Potheads and Oil Fuse Cutouts you need to meet most installation requirements.

G&W's new "Off-the-shelf" shipping system is unique and fast. Components of given assemblies are gathered from stock, checked, crated, and sent on their way. When you receive equipment in component form, your installation costs are minimized because you avoid needless disassembly time before the unit is installed.

This new shipping system is typical of improvements being made in G&W services. It is another example of why it pays you to rely on the acceptance, dependability, and quality standards that have made G&W specialists in the electric-power market. There is a pride of craftmanship in every product produced and attention given to detail is unexcelled in the industry. Thorough and precise workmanship means all the difference between years of trouble-free operation and the irritating and costly failures caused by inferior design and poor quality.

Look to G&W for all your cable accessory and switching needs. Contact a G&W Representative to answer your questions; or write us for full information.

G&W ELECTRIC SPECIALTY COMPANY
3514 WEST 127th STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFG. • POWERLITE DEVICES LTD. • TORONTO, MONTREAL & VANCOUVER

G 60-1

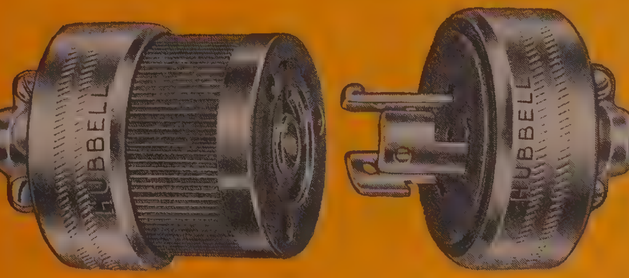
superior quality standards — inspired specialized design

ONLY

HUBBELL

MAKES RUGGED

Twist-Lock®



CAT. NO. **7313**
3-WIRE CONNECTOR BODY
20 AMPS., 250 VOLTS, A.C. OR D.C.
10 AMPS., 600 VOLTS, A.C.

CAT. NO. **7311**
3-WIRE CAP
20 AMPS., 250 VOLTS, A.C. OR D.C.
10 AMPS., 600 VOLTS, A.C.

Ever since it was first invented and introduced by Harvey Hubbell, Inc. back in 1930, "Twist-Lock" has provided greater convenience, safety and efficiency in the operation of motor driven tools and other portable electrical apparatus. The locking action insures positive contact in spite of rough treatment, heavy vibration and other conditions that might cause down-time.

Today, "Twist-Lock" is supplied in types, sizes and ratings to fit every industrial and commercial application. Units are available in 2, 3, 4 and 5-wire sizes. Every cap and connector body from 10 ampere to 50 ampere is available with "Seal-Tite" rubber covers for weatherproofing purposes, protection from dust and dirt, or from hard knocks and rough usage. Regular "Twist-Lock" units are supplied grounded and not grounded. Special non-interchangeable grounding types provide protection for 15 ampere, 125 volt or 277 volt applications.

IT PAYS TO HAVE GOOD CONNECTIONS
HUBBELL

HARVEY
HUBBELL
INCORPORATED
BRIDGEPORT 2, CONNECTICUT
In Canada: Scarborough, Ontario

engineering news

HARVEY HUBBELL, INCORPORATED
Engineering Department

"Twist-Lock" offers many wiring features which simplify installation, eliminate costly service call-backs, and provide dependable trouble-free life. The following are standard features of all regular "Twist-Lock" units:

Heavy Duty Construction

SOLID BRASS MOLDED-IN INSERTS HOLD CONNECTOR BODY TOGETHER SECURELY

Trouble-Free Wiring

UPSET BINDING SCREWS CAN'T COME OUT!

"Bed-Rock" Blade Stability

BLADES SOLIDLY ANCHORED WITH MOLDED-IN KNURLED RIVETS
LARGER SPUN-OVER AREA

"Speed-Easy" Wiring Convenience

HEAVIER SCREWS
LARGER BINDING HEADS
TERMINALS RECESSED IN CAP FOR EXTRA WIRING ROOM

Armor Plate Protection

RUGGED STEEL ARMOR PLATE SHELL FOR MAXIMUM PROTECTION AGAINST BREAKAGE

Adjustable Cord Grip

HEAVY ADJUSTABLE CORD GRIPS TAKE STRAIN FROM BINDING SCREWS

another major

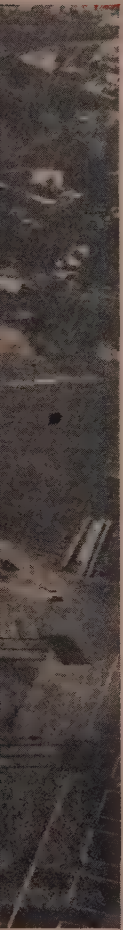
"PLAY BALL" will echo through Candlestick Park, new home of the San Francisco Giants, during the 1960 National League baseball season. Hatfield wire and cable has been used extensively for field lighting and other electrical services, in this newest, most modern ball park.

THE MOST UP-TO-DATE FACILITIES for the production of rubber insulated wire and cable are now in production at Linden, New Jersey. Hatfield's new automated Linden complex also includes a new copper rod mill. Adding the plastic insulated wire and cable facilities at Hillside, N. J., Hatfield now has more than 600,000 square feet of production space in operation.

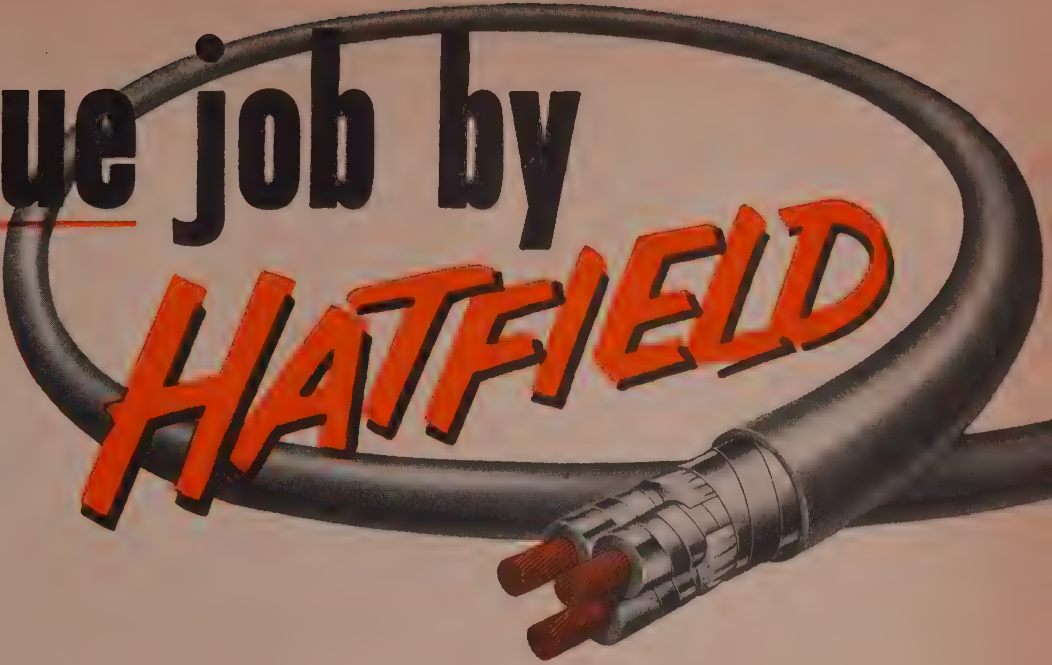
General Contractor, CHAS. L. HARNEY
Construction Management, MACDONALD, YOUNG and NELSON, INC.
Architect, JOHN S. BOLLES
Consulting Engineer, LYLE E. PATTON
Electrical Contractor, BRAYER ELECTRIC

MANUFACTURERS OF ALL TYPES OF INSULATED WIRE & CABLE

HATFIELD WIRE & CABLE



league job by HATFIELD

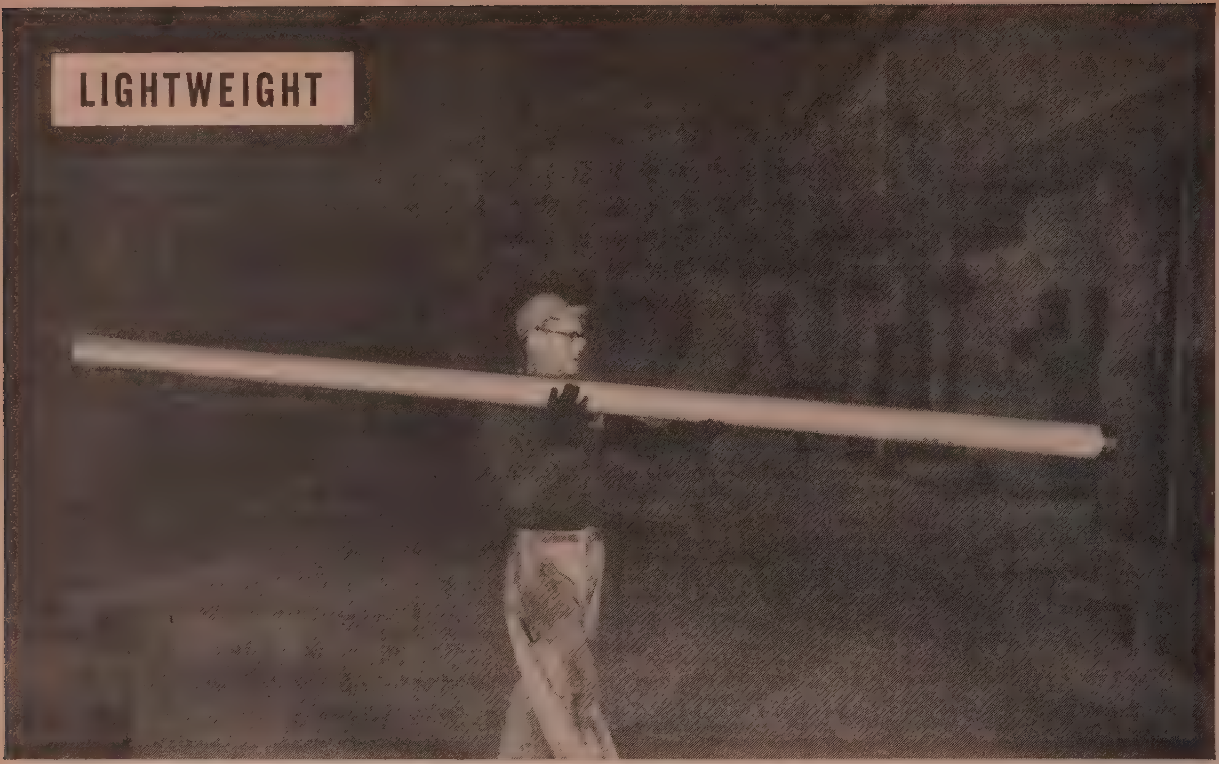


It takes "major league" wire and cable products to meet all kinds of requirements and come through with a winning performance every time. Because Hatfield's record ranks right up there with the all-time, all-weather, long-lasting greats in the wire and cable field, it is understandable why Hatfield products were specified for Candlestick Park — the new home of the San Francisco Giants. Few can match Hatfield's performance record, because Hatfield consistently "touches all bases". First . . . prompt, efficient service; Second . . . rapid delivery; Third . . . careful adherence to specifications; scoring every time . . . a complete line of plastic and rubber-covered wire and cable for construction, utilities and general industry. If you want the best, put Hatfield on your team.

HATFIELD PRODUCTS ARE SOLD EXCLUSIVELY THROUGH LEADING ELECTRICAL DISTRIBUTORS

DIVISION OF CONTINENTAL COPPER & STEEL INDUSTRIES, INCORPORATED
PLANTS-HILLSIDE, UNION, LINDEN • EXECUTIVE OFFICES-HILLSIDE, N.J.

CCA Continental

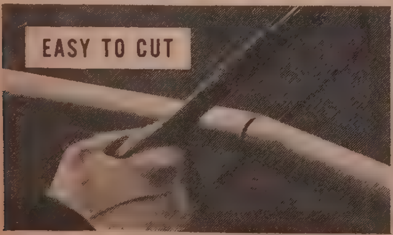


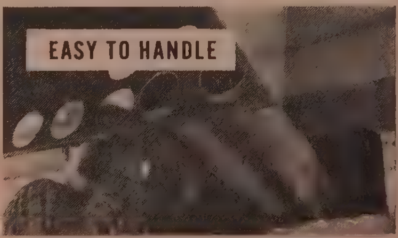
Reynolds Aluminum Rigid Conduit
REDUCES HANDLING TIME AND LOWERS COSTS

Lightweight Reynolds Aluminum Rigid Conduit weighs far less than conventional conduit. Electricians prefer it because handling and installation are easier and faster. Special tools for bending and forming are not necessary—nor is special equipment required for cutting or threading.

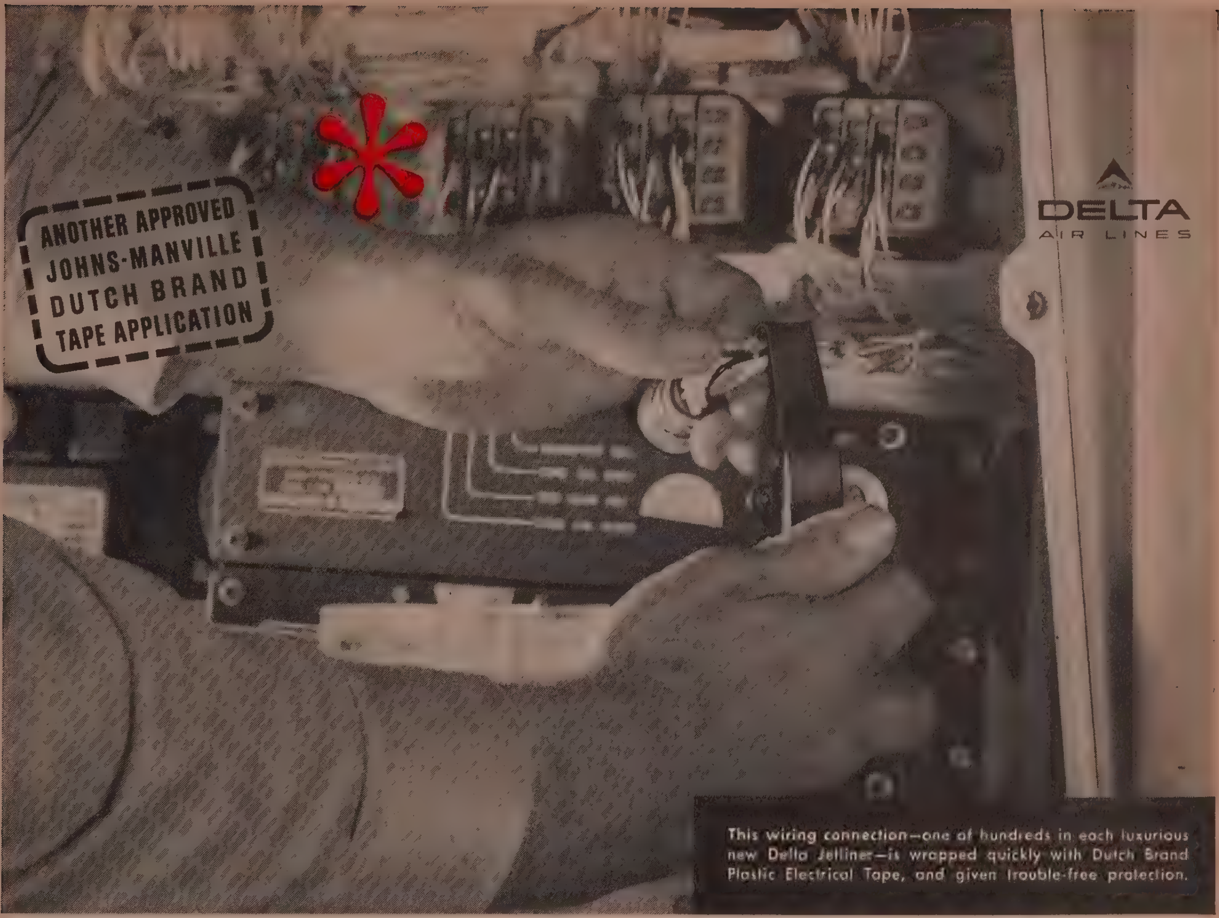
Aluminum conduit resists corrosion, thus it can be used in most industrial atmospheres. And, as aluminum conduit is non-magnetic, longer conductor runs or smaller conductors are often possible.

For complete information and names of Reynolds Aluminum Rigid Conduit distributors, call your Reynolds Sales Office or write *Reynolds Metals Company, Box 2346-ET, Richmond 18, Va.*





Watch Reynolds TV Shows: "Bourbon Street Beat" and "Adventures in Paradise"; and, resuming in October, "All Star Golf"—ABC-TV



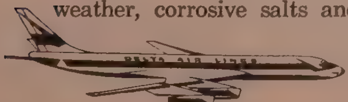
This wiring connection—one of hundreds in each luxurious new Delta Jetliner—is wrapped quickly with Dutch Brand Plastic Electrical Tape, and given trouble-free protection.

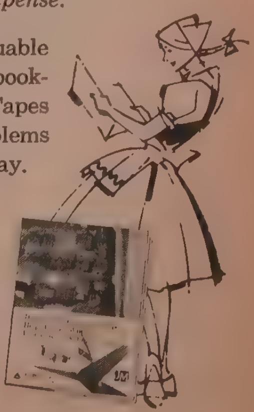
Why Delta Air Lines Chose
J-M Dutch Brand Plastic Electrical Tape for Trouble-Free Electrical Maintenance

* Before choosing Dutch Brand Plastic Electrical Tape for the new application of Jetliner maintenance, Delta knew the trouble-saving value of its *complete combination of protective properties* —Delta was already using 75 miles of the tape annually to service its prop fleet.

A single thickness of Dutch Brand Plastic Electrical Tape provided high dielectric strength. It resisted oil, grease, acids, alkalies, abrasion, weather, corrosive salts and fumes—almost all conceivable enemies of wiring connections. Easy to use, the tape adhered fast, readily stretched and conformed to irregular surfaces, wrapped and sealed tightly. A finished job of just one or two snug turns meant *trouble-free protection—at a savings of tape, taping time, expense.*

For idea-suggesting reading valuable in your operations, get the new booklet, "How J-M Dutch Brand Tapes Helped Solve Maintenance Problems at Delta Air Lines". Write today.





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JOHNS-MANVILLE DUTCH BRAND DIVISION
7800 South Woodlawn Avenue, Chicago 19, Illinois
In Canada—Johns-Manville Co., Ltd., Port Credit, Ontario

JOHNS-MANVILLE

6 bonuses when you specify and/or install PTC TRANSFORMERS

bonus NO. 1 . . . EXTREME QUIETNESS

Quiet transformer operation with low loss is a blessing and a real source of satisfaction to building owners, managers, top executives, employees and patrons. Therefore a superior low noise level is an extremely important reason why you should specify and/or install PTC transformers on all jobs.

Look at these PTC low noise levels as they compare with present and recommended NEMA specifications.

KVA Transformer Rating	Present NEMA	Precision Average Sound Level Standard Design	Special Design
9—30	50	40	34
37½—112½	55	42	38
125—167	60	44	42
200—300	62	48	46

To recognize the extreme quietness of PTC transformers it is best to compare them in decibel sound level ratings with those of typical sounds familiar to every-day life.

FOR EXAMPLE:

60-70 decibels—the sound of one typewriter or average traffic sounds 100 ft. away.

50-60 decibels—the sound of a vacuum cleaner or moderate restaurant clatter.

40-50 decibels—the noise to be found in an average residence or in normal conversation.

30-40 decibels—low conversation in a residence in the evening.

bonus NO. 2 . . . EFFICIENCY

Transformer losses cost money. Precision transformer cores ① use the lowest loss steel available. Precision transformers are wound with low resistance copper wire and designed for the greatest possible operation economy. These features reduce losses and save dollars not once, but year after year.

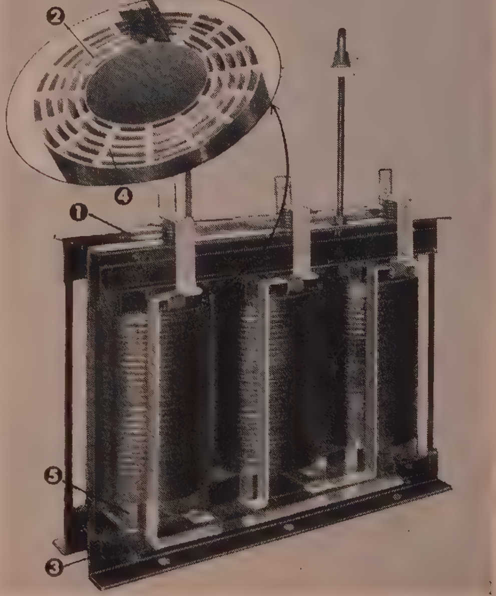
bonus NO. 3 . . . OVERLOAD CAPACITY

Precision transformers are designed with large open ducts ② for efficient cooling and operate at lower temperatures than specified in national standards. Superior PTC insulation materials, varnishes and wire enamels actually permit operating temperatures in excess of these standards with no loss of life. These factors together with low losses give Precision transformers unequalled ability to handle overloads.

bonus NO. 4 . . . DEPENDABILITY AND LONG LIFE

Dependability and long life can result only from ADVANCED DESIGN and BUILT-IN QUALITY. PTC transformers excel because they are constructed to meet the varying conditions under which they must be used. Additional PTC features are:

- Core laminations are clamped together with structural steel ③ rather than formed sheet steel for more rugged construction.
- Glass laminate duct spacers ④ used provide greater toughness, rigidity, dimensional stability, and moisture resistance far in excess of wood or paper phenolic laminate spacers.
- Coils are thoroughly clamped and braced around the core with fibre-glass laminate insulating blocks ⑤ resulting in greatest structural and tensile strength.
- Coils are made with an interlayer and interwinding insulation of Mylar-Quinterra and glass, assuring high dielectric strength, low moisture absorbtion and high temperature stability characteristics.



bonus NO. 5...REDUCED INSTALLATION EXPENSE

Well designed and easily accessible mounting provisions together with ample connecting space and simple wiring termination mean neater installations at lower than normal cost.

bonus NO. 6 . . . THE ONLY 5-YEAR UNCONDITIONAL GUARANTEE IN THE INDUSTRY

Your reputation as an electrical engineer or contractor depends upon YOUR ability to stand firmly behind your recommendations and installations.

It is reassuring to know that PTC transformers work because PTC people make them work — then stand unconditionally behind them.

WHISPER-QUIET INSIDE-THE-WALL INSTALLATION

Precision Transformer Corporation has developed a unit which installs *inside-the-wall* in otherwise unusable space. Precision's "HUSH-FLUSH" design permits easy, full accessibility, lowest noise level close to lead power service. Saves material and labor costs. Ideal for schools, libraries, hospitals, churches, theatres, etc. — wherever noise *must* be eliminated.

Complete Line—DRY and LIQUID Types

Whatever your transformer needs, there is a dependable, quiet, long-lasting dry or liquid type transformer . . . more than 4,000 models ranging from ¼ to 5,000 KVA.

Write today for 4-page brochure providing details on the PTC line.

PTC TRANSFORMERS
- QUIET
- EFFICIENT
- DEPENDABLE

PRECISION TRANSFORMER CORP.
2222 West Lake Street • Chicago 12, Illinois
Representatives in all principal cities

IN ELECTRICAL WIRE & CABLE . . . **THE SPARK OF QUALITY IS KAISER WIRE EXPERIENCE**

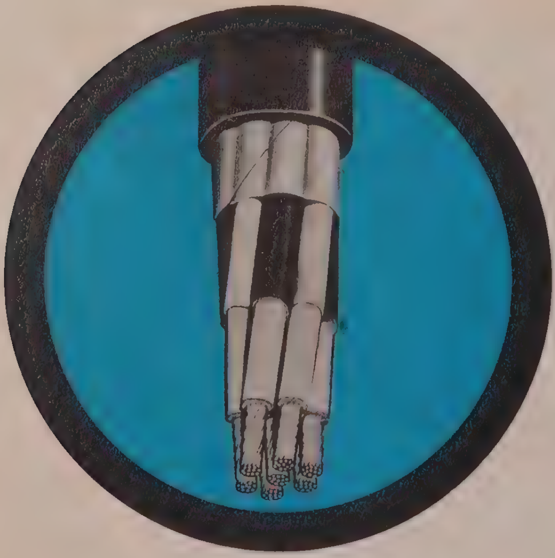
CONTROL CABLE... 28 YEARS OF PERFECT INSULATION SERVICE

KAISER MASTER LAYTEX® CONTROL CABLE has never known a reported insulation failure!...and the introduction of patented Laytex-Resin promises to improve upon this 28-year record of perfection!

Laytex-Resin is the combination of Laytex insulation with a specially-compounded resin layer over the insulation that eliminates the bulk of braided coverings. It brings the following advantages over extruded constructions:

Smaller diameter, to expand service without enlarging ducts...less weight...increased flexibility...proven greater insulation protection against acids, alkalies, flame, fungus, water, oil, ozone and light...uniform protection free of thin spots...can't wick moisture or fray...easier splicing...brighter color coding and longer lengths per reel.

SPECIFY 935-S. ASK FOR KAISER CONTROL CABLE BOOKLET.



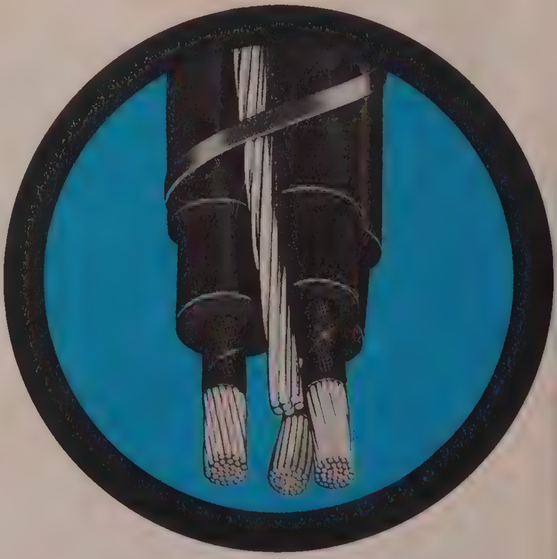
POWER CABLE... 16.4 TIMES MORE OZONE RESISTANCE

KAISER GRIZZLY® POWER CABLE is the only power cable to resist 6000 hours of high ozone shock test—outlasting 9 leading brands tested!

Several samples of each unshielded 5KV cable were placed with a "U" bend resting on a grounded metal plate. A conductor-to-plate potential of 40,000 volts was applied until all cables failed. Four brands failed immediately. The last competitor gave out 432 hours before the first Kaiser cable. Kaiser Grizzly samples went on to last over 6000 hours . . . 16.4 times longer than the test average of best performances . . . 2.4 times the life of the nearest competitor.

The reason: A superior combination of Kaiser insulation and jacketing. In power cables it represents a major victory over the main cause of failure—dielectric breakdown due to ozone.

AVAILABLE IN A WIDE RANGE OF SIZES AND SPECIFICATIONS FOR OVERHEAD AND UNDERGROUND HIGH-VOLTAGE APPLICATIONS.



K/W PORTABLE CORD... NEARLY THREE TIMES AS MUCH SERVICE

KAISER MASTER LAYTEX® PORTABLE CORD is tested and proven to give nearly three times the service, on the average, of cords of equal price. A saving of two-thirds in actual cord costs on the job!

This superiority came from Kaiser research into all causes of portable cord failure—more than 12,000 individual tests comparing more than 1000 cords of all makes.

The results: Patented K/W portable cord with a lead-cured 60% Neoprene jacket surpassing ASTM D-752 requirements from 15% to 100%... rayon fillers for overall resistance to pull... fibrous core inside the conductors to absorb strain, increase flexibility . . . conductors perfectly centered in grainless Kaiser Laytex insulation which has three times the strength of milled natural rubber.

SPECIFY NO. 920 FOR HEAVY DUTY (600 V.), NO. 921 FOR LIGHT DUTY (300 V.). ASK FOR KAISER MASTER LAYTEX® PORTABLE CORD BOOKLET.

IN ELECTRICAL WIRE & CABLE THE SPARK OF QUALITY IS K/W EXPERIENCE

The spark of quality means positive—often dramatic—savings in service for those who will specify Kaiser wire and cable.

Among the world's leading electrical wire and cable producers, only Kaiser is heir to the 70-year experience of a major rubber company in developing insulation and jacketing compounds.

Insulations such as Laytex®, Laytex-Resin, Hydrosec® and Kalzone give greater utility, longer life to a complete range of aluminum or copper conductors. For immediate service in any type of wire or cable, call your K/W Distributor or Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center,

300 Lakeside Drive
Oakland 12,
California.

KAISER ALUMINUM

A MESSAGE TO AMERICAN INDUSTRY • ONE OF A SERIES

Recent Economic Growth — The Numbers Game

If it truly portrayed recent rates of economic growth in the United States, the report on employment, growth and price levels recently issued by the staff of the Joint (Congressional) Economic Committee would point up scarcely less than a national disaster. Among other things, it would document impressively Premier Khrushchev's crack that "the capitalist steed the United States is riding . . . is worn out."

One of the major findings of the Joint Committee's staff (in the Eckstein Report, named for its staff director Otto Eckstein) is that between 1953 and 1959 the average rate of growth of physical output in the United States was only 2.4 per cent per year. This is scarcely more than half the average annual rate of growth of 4.6 per cent the staff found to have prevailed between 1947 and 1953.

Happily, however, the report does not reflect the basic economic realities. Its finding on relative rates of economic growth for the two periods is a statistical *tour de force* which, by the selection of certain figures and certain dates, distorts the record of America's long-term economic growth.

Playing The Numbers Game

By the selection of appropriate starting and terminal periods it is possible to document almost any rate of economic growth that is desired. The table at the bottom of this page shows you how this can be done. It will also show you how the Eckstein staff worked out its shocking contrast in growth rates. The table is built like a schedule of airplane fares between different cities. The postwar years 1946 through 1959 are put down on two axes. One runs down the left hand column, the other runs across the top of the table. Put your finger on the point where the two axes intersect and you have the average rate of growth for the period covered.

ANNUAL AVERAGE GROWTH RATES OF THE U.S. ECONOMY, 1946-1959*

(Percent increases, starting year to terminal year, of GNP in 1954 dollars).

Starting Year	Terminal Year													
	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
1946	X	–0.1	–1.9	–1.2	3.0	3.9	3.8	3.9	3.2	3.7	3.6	3.4	2.9	3.2
1947	X	X	3.8	1.8	4.1	4.9	4.6	4.6	3.7	4.2	4.0	3.8	3.2	3.5
1948	X	X	X	–0.1	4.2	5.3	4.8	4.7	3.6	4.3	4.0	3.8	3.1	3.4
1949	X	X	X	X	8.7	8.1	6.5	6.0	4.4	5.0	4.6	4.2	3.5	3.8
1950	X	X	X	X	X	7.4	5.4	5.1	3.4	4.3	3.9	3.6	2.9	3.3
1951	X	X	X	X	X	X	3.4	3.9	2.0	3.5	3.2	3.0	2.2	2.8
1952	X	X	X	X	X	X	X	4.4	1.3	3.6	3.2	2.9	2.0	2.6
1953	X	X	X	X	X	X	X	X	–1.6	3.2	2.8	2.6	1.6	2.4
1954	X	X	X	X	X	X	X	X	X	8.1	5.1	4.0	2.4	3.2
1955	X	X	X	X	X	X	X	X	X	X	2.1	2.0	0.5	2.0
1956	X	X	X	X	X	X	X	X	X	X	X	1.8	–0.2	2.0
1957	X	X	X	X	X	X	X	X	X	X	X	X	–2.3	2.0
1958	X	X	X	X	X	X	X	X	X	X	X	X	X	7.0
1959														

*Compound rates of growth

Following this procedure, you can find growth rates ranging all the way from —2.3 per cent, between 1957 and 1958, to +8.7 per cent, between 1949 and 1950, along with almost any other rate you would choose for various years and sequences of several years over the postwar period.

For example, if you want to demonstrate that the postwar growth rate through 1953 was less than 4% per year, you take off from 1946, include a drop of 0.1 per cent between 1946 and 1947, and come up with a growth rate for the 1946-1953 period of 3.9 per cent. But if you want to show it was quite high, you take off a year later, from 1947 (which drops out that dismal —0.1 per cent for 1947) and come up with a fine growth rate of 4.6 per cent for the 1947-1953 years.

Statistical Hocus-Pocus

That's what the Eckstein staff did. It took off at one end from a year when there was just about no growth, went to the Korean War boom year of 1953 at the other end, and got that average growth rate of 4.6 per cent. Then it took off from the Korean War boom year of 1953 and ran to the year 1959, when business was recovering from a recession and suffered through a steel strike of 116 days, to come up with its 2.4 per cent growth rate for the second postwar period. As the table indicates, by taking off a year later (1954) the average growth rate would have become 3.2 per cent, and if the take off had been 1949 it would have been 3.8 per cent.

There are those who, in nontechnical terms, would characterize this as statistical hocus-pocus. There are also those who would see in it an element of political hocus-pocus, too. This is because the years 1947-53, when the Eckstein staff found there had been the healthy 4.6 per cent growth rate, were roughly years when we had a Democratic president, while the anemic growth rate of 2.4 per cent it calculated for the subsequent years was for years of a Republican presidency.

Actually it can be shown that the civilian part of our economy has had more rapid growth during the Republican administration than it had during the Democratic years. If military expenditures are subtracted from the national ouput, the resulting growth rate for 1953 to 1959 is slightly higher than for 1947 to 1953.

However, we do not question the *bona fides* of the Eckstein staff. **But we do assert that it has produced a statistical picture of the postwar growth of the American economy which is dangerously misleading both at home and abroad.**

Abroad, the report appears to give official documentation to the propaganda line that the Soviet economy is running rings around the U.S. economy in growth, and that it is Communism a country should choose if it really wants to develop rapidly. Building on a much smaller economic base than the U.S.A., the Soviet Union — as well as almost every less advanced nation in the world — is bound to show a larger percentage increase in output than the U.S.A. But the Eckstein staff calculation gives the Communists ammunition they don't deserve.

Are We Facing A Crisis?

The contrast drawn by the Joint Committee staff in postwar U.S. growth rates suggests that we are facing scarcely less than a crisis through paralysis of our economic growth which calls for drastic remedies. But this, as the full 1947 to 1959 growth record set forth in the table makes clear, is very definitely not the case. Our over-all postwar rate of growth, as measured by the gross national product in physical terms, has been 3.5 per cent per year, a rate nearly double the long-term growth rate of 2 per cent per year between 1909 and 1939. In the continuing fluctuations in the rate of growth which more or less inevitably characterize a relatively free economy, we have had some downs in recent years. **But our economy is now on the upbeat again. And at the end of this year, the U.S. economic growth rate for the postwar period can be expected to be 3.7 per cent per year.**

It is extremely important for the United States to continue to maintain this rate of economic growth or even to surpass it. Upon this effort depends our capacity to meet our defense requirements without dangerous strain, to provide an adequate margin for foreign aid, to improve our own productive facilities, and to continue to raise our own standard of living.

How not only to maintain but possibly improve upon our postwar pace of economic growth will be the subject of strenuous debate in the months ahead. However, the debate will have a much better chance of being constructive if the postwar growth record is seen in proper perspective. To this end one of the first things to do is to junk panic rousing statistical portrayals such as that in the Eckstein report.

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Donald C McGraw

PRESIDENT

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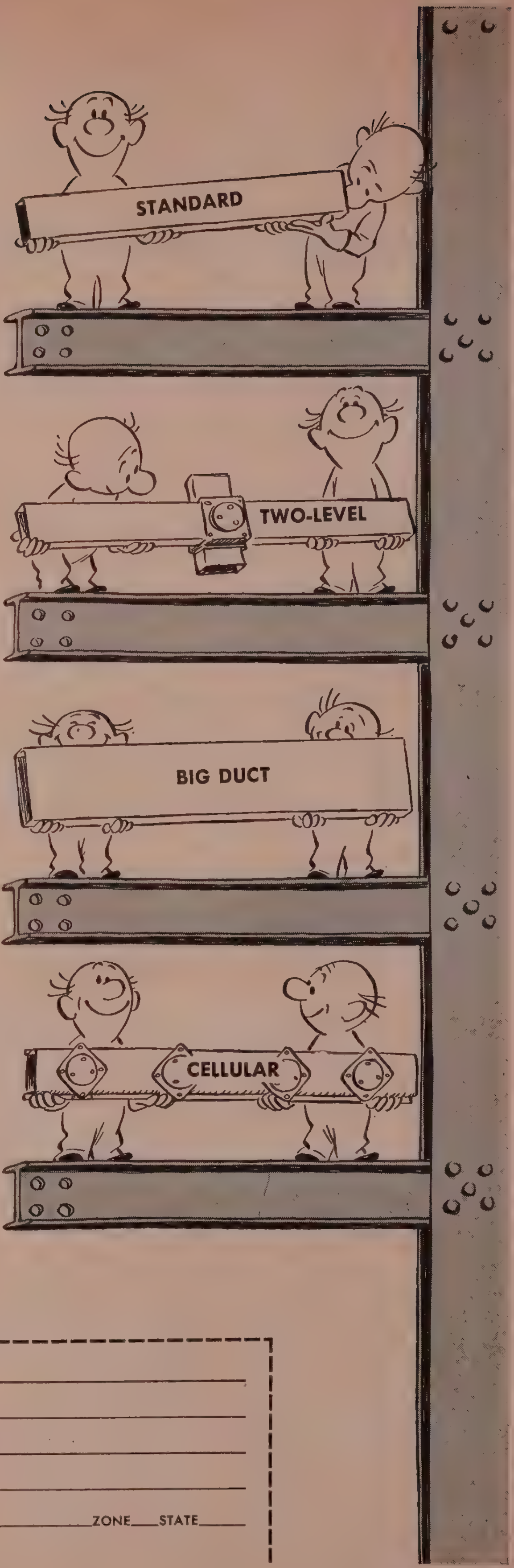

General Electric makes a complete line of steel underfloor wiring systems—one for every type of floor construction.

Big buildings, little buildings and middle-sized buildings can provide more electrical services with a G-E steel underfloor wiring system. General Electric makes a system for every type of floor construction. Here are the four G-E underfloor systems, and some of the features that make them so easy to work with:

G-E Standard System can be installed in poured concrete floors 2½ inches thick. Inside cross-sectional area is 3.357 square inch. On triple duct systems, all systems can be fed through conduit openings in the corners of the boxes. Junction boxes can be leveled without removing covers.

G-E Two-level System, for complex feeding problems, normally feeds through lower level, distributes through upper level. Requires 3½ inches floor fill.

In multi-system installations each system is completely separate. Additional feeds for any system can be provided at any desired location.

G-E BIG DUCT gives lots of capacity in a simple, low-cost system requiring only 3 inches of floor fill. Interior cross-sectional area is 8½ square inch. Increased cross-sectional area gives more space, makes wire pulling much easier.

G-E Cellular-steel Floor Wiring System installed on a structural cellular floor provides maximum capacity with maximum flexibility. G-E header duct for cellular installations is available in lengths that make it easier to center junction units over floor cells, and to take up minor variations in cell spacing without cutting and fitting on the job. Junction unit interiors are completely free of any screws or other encumbrances thereby providing maximum work area.

For valuable manuals that contain complete installation, layout, design and product data, just fill in the coupon and mail it to General Electric.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Company
Conduit Products Department, Section CU92-618
Bridgeport 2, Connecticut

☐ Please send me your bulletin on single- and two-level steel underfloor wiring systems.

☐ Please send me your bulletin on cellular-steel floor wiring.

☐ Enclosed is a description of my underfloor wiring problem. What do you suggest?

NAME________________________
TITLE________________________
COMPANY________________________
ADDRESS________________________
CITY____________ZONE____STATE_____

R

PLH
Ring Type Bus Support for Tubular Bus

U

SBC
Sliding Bus Support for Tubular Bus

PSSQ
Bus Support for Square Tube

G

HPS
Hook on type Bus Support Clamp for Tubular Bus

CS
Bus Support Clamp for Cable

G

PSS
Tubular Bus - Support Clamp

DOSSERT HIGH-STRENGTH BUS SUPPORTS

E

SHV
Vertical Bus Support Clamp for Flat Bar

- Higher cantilever strength
- Higher impact resistance
- Higher corrosion resistance
- Greater durability

These Dossert Bus Supports are made of a high tensile strength cast bronze alloy and are equipped with silicon bronze bolts and nuts, making the entire unit completely non-magnetic. Available for all sizes and types of busses. Dossert Bus Supports can also be furnished in Coupling, Tee Connecting, Elbow Connecting, Tee Coupling and Expansion Connection types.

Special fittings and modifications can be readily supplied on short notice.

SAV
Vertical Bus Support Clamp for Flat Bar

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50
YEARS OF TECHNICAL KNOW HOW

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249 Huron Street, Brooklyn 22, N.Y. • Representatives in all principal cities
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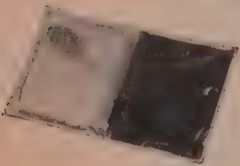
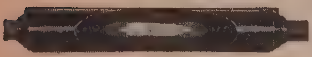
Inside story of REG. U.S. PAT. OFF. SCOTCHCAST BRAND Resin Splices

"SCOTCHCAST" BRAND Resin No. 4 is an epoxy resin developed especially for field splicing. Weathering, moisture, pressure, or general aging encountered in normal burial or overhead service does not affect it—field splices can now have the same modern, complete protection and insulation as shopcast motor coils, transformers, and condensers. Convenient kits assure positive electrical insulation, corrosion protection, moisture resistance, and trouble-free maintenance splice after splice!

"SCOTCHCAST" SPLICING KITS



Kits feature "SCOTCHCAST" Resin No. 4 in single-use "Unipak" Container. Two-Part plastic bag contains resin and hardener. To use, bag divider seal is broken; laboratory correct mixture results. Resin is poured right from bag into mold; sets in minutes. Kits are for use on all non-shielded cable splices.



82-A Series Kits for straight or inline splices with cable O.D.'s from $\frac{1}{4}$" to $1\frac{7}{16}$". Contains everything needed to insulate one splice: "SCOTCHCAST" Resin No. 4 in "Unipak"; mold halves; pouring spouts; sealing tape. Cutaway photo shows complete blocking of moisture-entry points.

82-B Series Kits for excellent electrical and physical protection of wye splices with cable O.D.'s from $\frac{1}{4}$" to $\frac{5}{8}$". Cut-away shows moisture proof penetration of "SCOTCHCAST" Resin No. 4 into all voids of splice mass.

90-B1 Kit for positive protection of wye or tap splice, insulation over split-bolt connectors or control cable taps. For surface or underground uses. Like all "SCOTCHCAST" Kits, assembles quickly and easily; gives electrically tight splice protection without need of special skills.

"SCOTCHCAST" RESIN PRESSURE SPLICE

With the "SCOTCHCAST" Resin Pressure Method, cable splices and terminations, regardless of size or configuration, can be insulated easily . . . difficult jobs such as shielded cable splices, terminations, and sheath repairs are readily accomplished. Method utilizes "SCOTCHCAST" Resin No. 4 in "Unipak" container injected into a screen-fabricated mold by specially designed pressure gun.

Cut-away inline splice shows complete penetration of resin with pressure-splice method. Will insulate splices on rubber, synthetic or lead insulation or sheath cable . . . shielded and unshielded.

Shielded wye splices are easily handled with "SCOTCHCAST" Pressure Splice Method. Shielding continuation is built into the splice insulation. Total moisture and physical protection is an extra feature of this method.

Outdoor cable termination illustrated is for use at 9 KV. Lower cut-away portion shows stress cone. Entire termination—including stress cone—is resin saturated in one operation. Available in building block components up to 15 KV.

The versatility of the "SCOTCHCAST" Splice Protection System is such that nearly any type of cable connection or termination can now be resin insulated. Our representatives will be glad to advise or assist you in adapting "SCOTCHCAST" Kits and Pressure Methods to your needs. Just write on your letterhead.

FREE BOOKLET describes "SCOTCHCAST" KITS and Pressure-Splice Method. Illustrates applications; details electrical properties. Write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. EAW-60.

"SCOTCHCAST" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK 16. CANADA: LONDON, ONTARIO.

MINNESOTA MINING AND MANUFACTURING COMPANY

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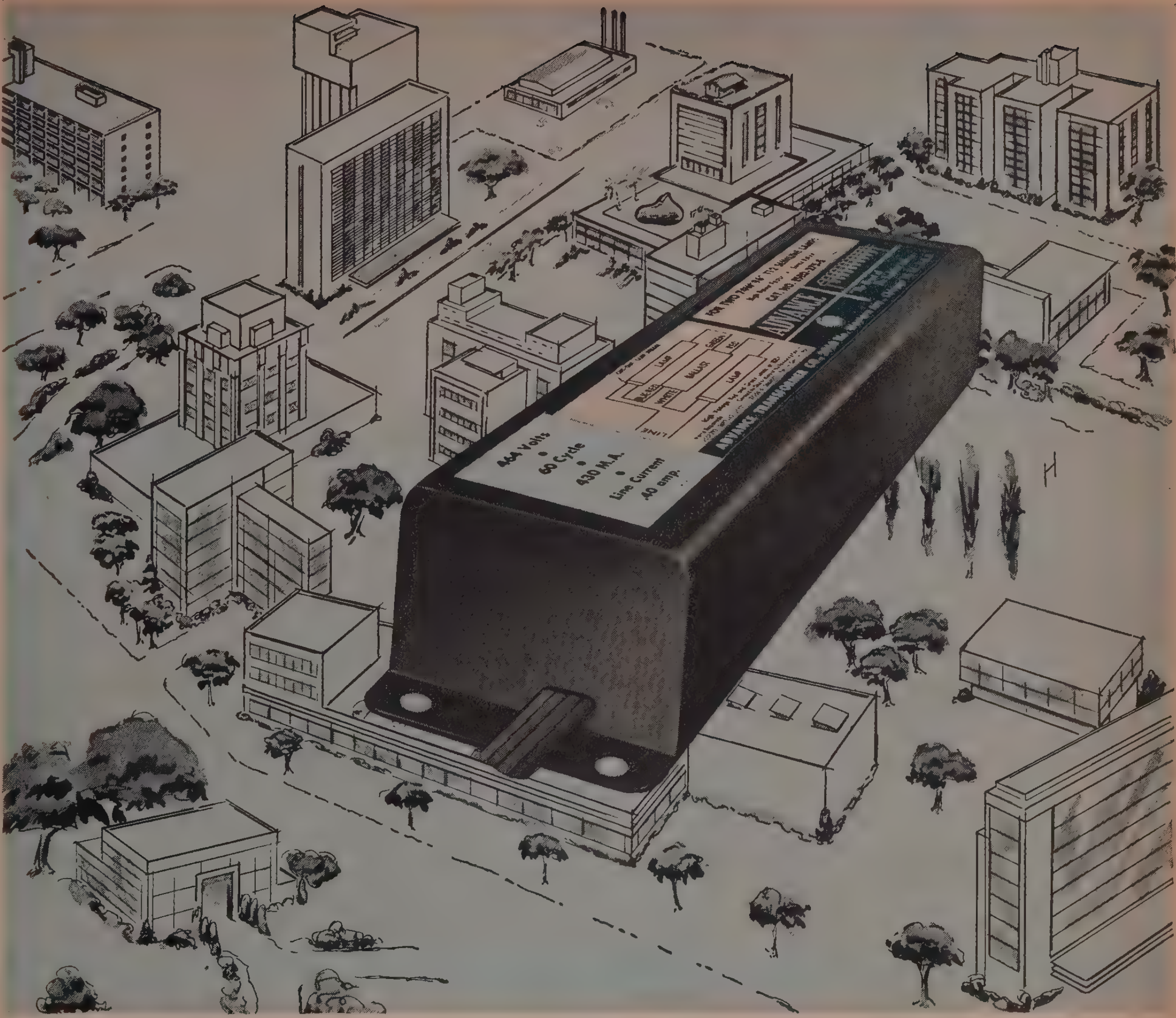
3M COMPANY



TO SOLVE MORE DEMANDS IN MORE APPLICATIONS FOR MORE LIGHT

Increasing with today's architectural demands on the Fluorescent Lighting Industry are the problems relating to the operation, efficiency and life of a Fluorescent Lamp Ballast.

To aid the Fluorescent Lighting Industry in meeting these demands Advance Transformer Company has contributed such important developments as Kool Koil Fluorescent Lamp Ballasts • Single Case Ballasts to operate VHO, SHO, and PG lamps • Advan-Guard Fluorescent Lamp Ballasts, incorporating a thermally actuated automatic protective device • Visa-Volt Color Coding for positive voltage identification • A Nation-Wide Service Stocking Distributor Program • FLB Service Warranty Program . . . All important Advancements keeping pace with the Fluorescent Lighting Industry's great strides. Whether you manufacture, specify, install, use, or maintain fluorescent lighting systems, remember Advance, through constant research, development and manufacturing know-how, is building ballasts that meet today's exceptional demands. Write for details of these Advancements . . .

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GENERAL ELECTRIC

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- Faster shipment
- Complete service

NOW stocked

SYMBOL OF FULL VALUE

With this seal, General Electric certifies full value for your transformer dollar; full value in terms of superior basic design, features, and performance . . . plus faster order handling and shipment . . . plus complete service before, during, and after installation. No other transformer manufacturer can match this complete General Electric package.

for shipment in one week

Delivery faster on popular ratings of lighter, redesigned General Electric Distribution Equipment Transformers

Factory stocking of the most frequently ordered ratings of Distribution Equipment Transformers* now permits General Electric to ship your order in only *one week*.

Just one week (for final testing and assembly) after your order is received, the transformer is on its way to your installation. This means that delivery to you is as much as five weeks faster. The stocked ratings include:

OA-T-60-500 kva—4160 Delta—480Y/277
OA-T-60-300 kva—4160 Delta—208Y/120
OA-T-60-225 kva—4160 Delta—208Y/120
OA-T-60-500 kva—4160 Delta—208Y/120
OA-T-60-300 kva—4160 Delta—480 Delta

Other ratings in the 112½- to 2500-kva range can be shipped in just six weeks.

14% lighter, two designs

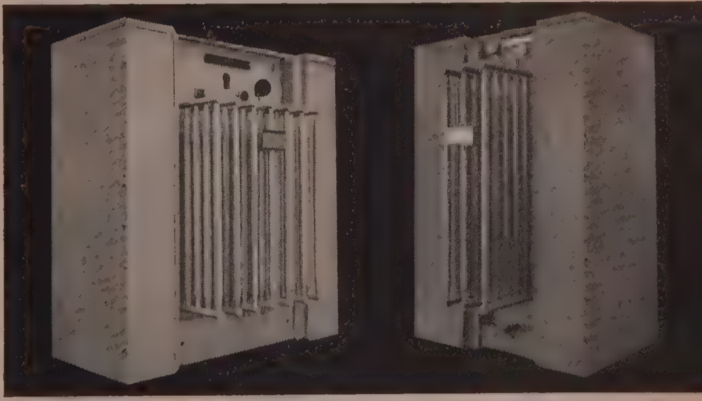
The complete line of Distribution Equipment Transformers has been redesigned to provide a unit which is both 14 percent lighter and mechanically stronger than previous models.

Two standard designs are available for cable connection to remote apparatus or as integral parts of unit substation equipment. The conventional three-legged core construction is provided in ratings 300 kva and above, and the space saving stacker-type unit is supplied for ratings 112½ to 225 kva.

Faster shipment is typical of the many benefits available with General Electric's Certified Full-value transformers. For full data contact your G-E Apparatus Sales Engineer or Agent. General Electric Co., Schenectady 5, N. Y. 417-10

STACKER-TYPE construction features wound core for more efficient transformer.

STURDY CONSTRUCTION makes three-legged design well suited for industrial use.



TWO DESIGNS of Distribution Equipment Transformers are available, conventional three-legged (left) and stacker-type.

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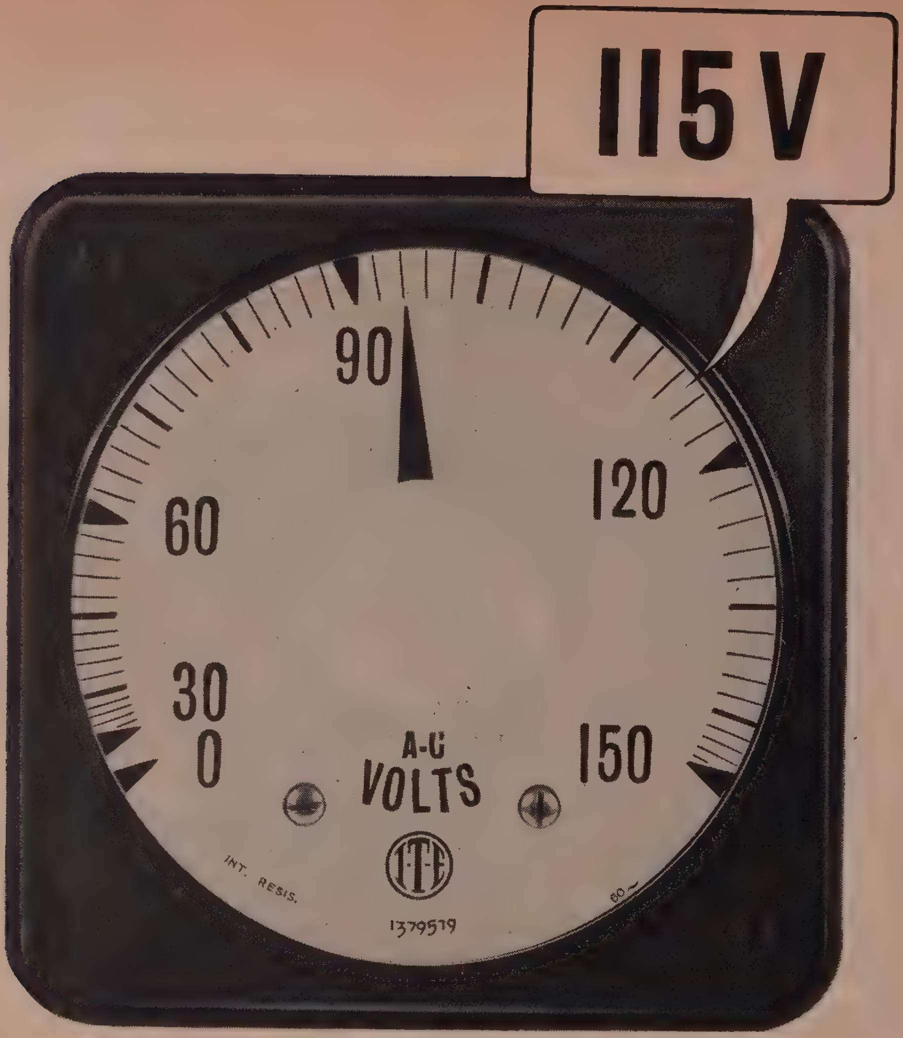
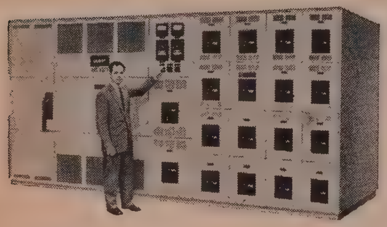
* Oil and Pyranol Filled, 112½ to 2500 kva
Pyranol is a Reg. Trade-mark of General Electric Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC



"But I was positive we didn't need another substation!"



MORAL: For good voltage regulation and better operating efficiency, put a secondary unit substation in each load area. And for complete information on today's most value-packed line of substations, write for Bulletin 3104-1A, I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton Street, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

DO IT FASTER · DO IT BETTER

with

STEELDUCT E.M.T.

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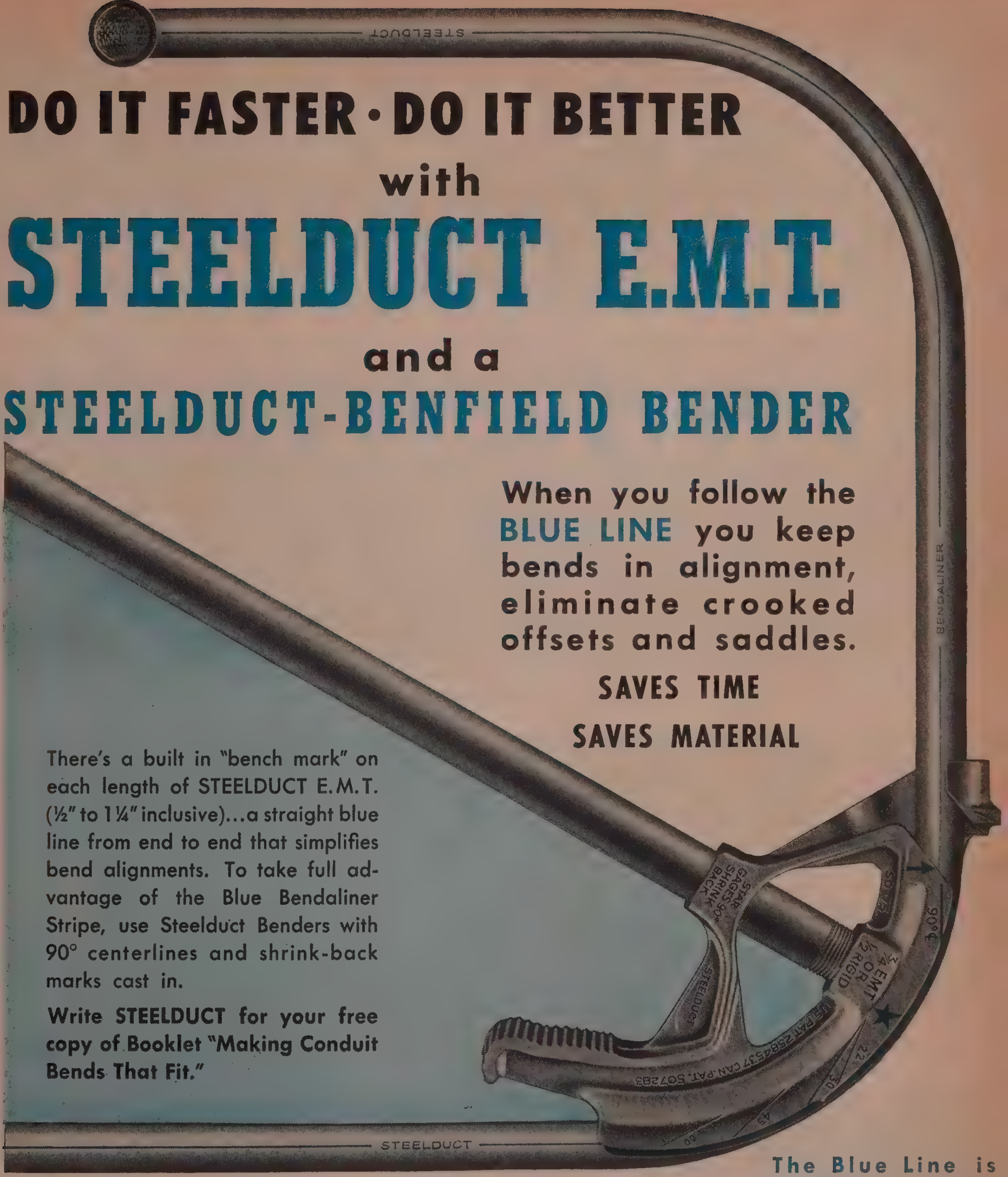
STEELDUCT-BENFIELD BENDER



When you follow the BLUE LINE you keep bends in alignment, eliminate crooked offsets and saddles.

SAVES TIME

SAVES MATERIAL

There's a built in "bench mark" on each length of STEELDUCT E.M.T. (½" to 1¼" inclusive)...a straight blue line from end to end that simplifies bend alignments. To take full advantage of the Blue Bendaliner Stripe, use Steelduct Benders with 90° centerlines and shrink-back marks cast in.

Write STEELDUCT for your free copy of Booklet "Making Conduit Bends That Fit."

The Blue Line is the Mark of Quality

Steelduct Products are UL approved and meet Federal Specifications WW-C-571a, WW-C-581c, WW-T-806b.

THE STEELDUCT COMPANY

REPUBLIC STEEL BUILDING YOUNGSTOWN 1, OHIO

PERIMETER LIGHTING helps prevent trespassing and costly pilfering.

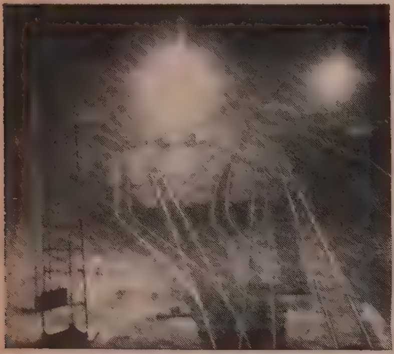
ARCHITECTURAL LIGHTING will add prestige and beauty to buildings.

SHOPPING CENTERS boost nighttime business when brightly lighted.

LOADING DOCKS become safer, more efficient when properly lighted.

FACADE LIGHTING gives safety, identification to building and store fronts.

GRAND COULEE DAM lighted by 742 General Electric 1500-watt floodlights.



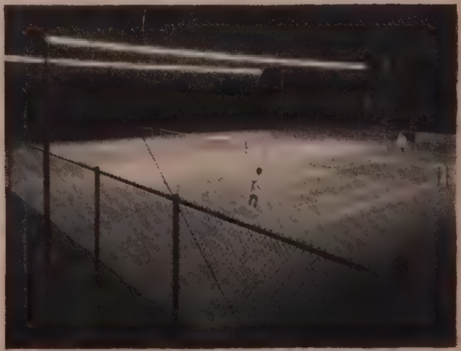
RAILROAD YARD lighting cuts accidents, thefts and costly freight damage.

FOUNTAINS assume day-time beauty with brilliant, multi-colored floodlights.

NIGHT CONSTRUCTION is safer and more practical with floodlighting.

ATHLETIC FIELD lighting lengthens the time available for fun and play.

DOCK FACILITIES nighttime usage is greatly increased with floodlights.



TENNIS COURTS attain round-the-clock use with modern floodlighting.

When light means more safety, fun, beauty, or efficiency, General Electric floodlights will do it best—at least cost

STORAGE YARDS can be just as accessible at night as they are by day.

PLANT ENTRANCES need modern lighting to facilitate visitor checking.

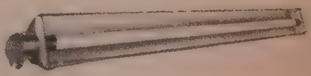
GUIDE SIGN lighting adds convenience, safety to highway travel.

AIRPORTS become safer, and more convenient with proper floodlighting.

As floodlights in these 16 areas are switched on there is an immediate addition of beauty, safety, efficiency. Nighttime crowds fill the lighted recreational areas; movement of raw materials and finished goods is speeded on lighted loading docks; a fountain with multi-colored lights becomes a nighttime landmark.

These are typical results of proper outdoor lighting. The benefits are many—the applications unlimited. But, regardless of the job to be done—from Grand Coulee Dam to highway guide signs, from Milwaukee's County Stadium to railroad yards—General Electric has experience to do the job best . . . and a full line of floodlights to do it at least cost:

FILAMENT OR MERCURY LIGHTING is simple with any of General Electric's L-69A (high efficiency), L-80 (heavy-duty enclosed), or L-55 (economy open-type) units. Each of these floodlights features G.E.'s exclusive "diamond back" reflector . . . designed to deliver from 5% to 35% more light . . . and distribute it more uniformly.



FLUORESCENT LIGHTING units are available in 4-, 6-, and 8-foot lengths. Two housings are offered—one for G.E.'s High Output lamps—the other for G.E.'s Power Groove lamps.

Here's an added benefit—over 500 conveniently located distributors are ready to supply General Electric floodlights and technical aid for your installation. Call your nearest distributor—ask for General Electric's *new* Floodlighting bulletin with descriptions, application information, and product data on the complete line. G-E Easy Lighting Layouts are also available for most floodlighting applications. Use the coupon below if you don't know the distributor in your area.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Company, Section A460-04, Schenectady 5, N. Y.

Please send me free floodlighting information as indicated below:

☐ Floodlighting—Bulletin GEA-7201

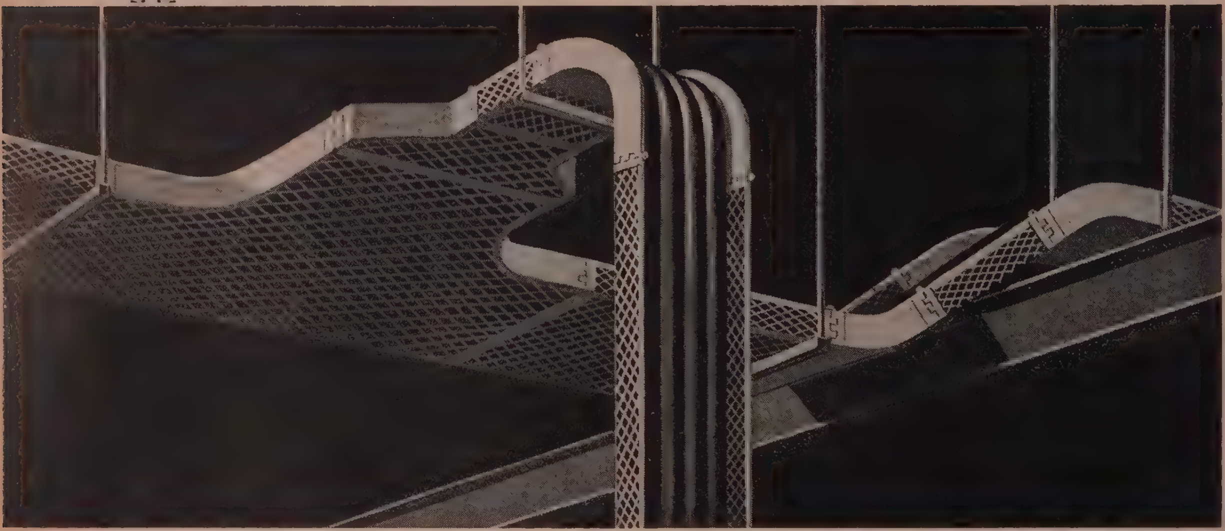
☐ Easy Lighting Layout for ______ Application

Name ______

Street ______

City ______ State ______

WHY NOT THIS?



COPE WIREWAY CABLE SUPPORTING SYSTEMS SAVE "3 WAYS" OVER "TRADITIONAL" MATERIALS

Why pay a premium for your cable supporting equipment—when Cope Wireway offers a *completely integrated system* for much less. Compare these facts for yourself.

- ***Lower material cost—***
  One section of 24" wide Wireway supports *as many cables* as 16 lengths of 4" conduit—at only 1/10th the weight. That means you're buying much less materials regardless of the size of the job.
- ***Less to install—***
  Wireway's lightweight and unique coupling method, speeds joining of straight lengths and fittings—even in close quarters. A Cope system comes *complete* with all necessary accessories—ready to go.
- ***Built-in expansibility—***
  With Wireway, you need not be concerned about costly re-routing or later additions to your system. Cables are always readily accessible and Cope's pin type couplers can be quickly disconnected to permit change in direction or elevation.

Ask for proof! *See your authorized Cope Electrical Wholesaler* for more information on economical Cope Wireway—in either aluminum or hot dipped galvanized steel. Or write us direct.

1102

COPE

Originators of the first integrated line of Cable Supporting Systems

• WIREWAY • CHANNEL • LADDER • CONTROLWAY

Sold only through authorized electrical wholesalers

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BELL makes and recommends only SOLID BRASS WEATHERPROOF WIRING DEVICES

Bell's field and laboratory tests have proved that only rugged, Solid Brass weatherproof plates can stand up, year in — year out, regardless of weather and heavy use.

Want more proof . . . just look at this list of exclusive Solid Brass advantages

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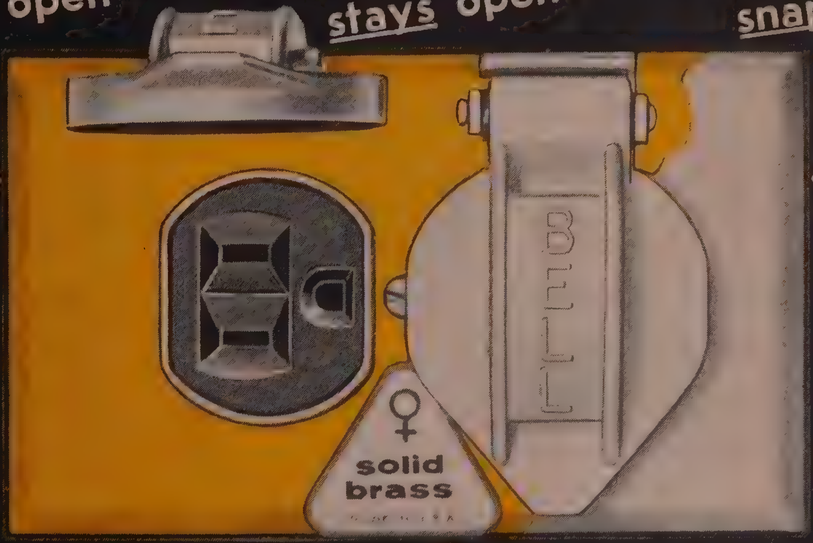
- **Bell Solid Brass** wears better, lasts much longer in any climate . . . even in coastal areas

SOLID BRASS PLATE *with* Saf-T-Lok® COVER

snaps open stays open snaps shut



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Write for fully illustrated catalog

Look for this Label . . . A sign of Quality

BELL ELECTRIC COMPANY 5735 S. CLAREMONT AVENUE, CHICAGO 36, ILLINOIS
America's Largest Line of Weatherproof Devices and Covers

All your answers are in the bag with PYRAMID

Amprobe Test-Master Kit keeps all equipment right at hand...handsomely.

Truly the sign of the professional, this rugged, good-looking, genuine cowhide case contains all the equipment *you* need to do all your electrical testing jobs with precision and accuracy.

Compact, neat and sturdy, the Test-Master Kit is specially designed to hold any one of the famous Amprobe RS models, the Amprobe Deca-Tran, the Amprobe Energizer and the Test-Master has a separate covered section to hold your small hand tools easily, within reach.

The Test-Master comes in two models: **TM33** contains the world-famous Amprobe RS-3 snap-around volt-ammeter-ohmmeter: 5 current ranges, 3 voltage ranges. Amprobe Deca-Tran: Extends amperage reading 10x, as high as 1200 amps. Amprobe Energizer: Multiplies sensitivity of any Amprobe 10x for readings on small appliance and fractional h.p. motors. **$84.50**

TM11 contains the Amprobe RS-1, economy snap-around volt-ammeter. Amprobe Deca-Tran and Amprobe Energizer. **$71.75**

The Amprobe Test-Master Kit, RS-3, Deca-Tran and Energizer are all products of
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59TH YEAR • JUNE, 1960

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Plain Prices

Residential electrical modernization work is plentiful. But there are a lot more homes in urgent need of enhanced housepower that the industry doesn't hear about. Their owners are reluctant to call in an electrical contractor because they have no notion of what such work costs or the prudent way to buy it.

Some excellent articles written for consumers have stimulated a great deal of interest and pretty fair understanding of the needs. Where they bog down is on probable costs and buying practice. Since electrical work is a relatively infrequent purchase, the buyer has little if any experience to guide him. So when he gathers the courage to take the plunge, he is often advised to call for three or four competitive bids.

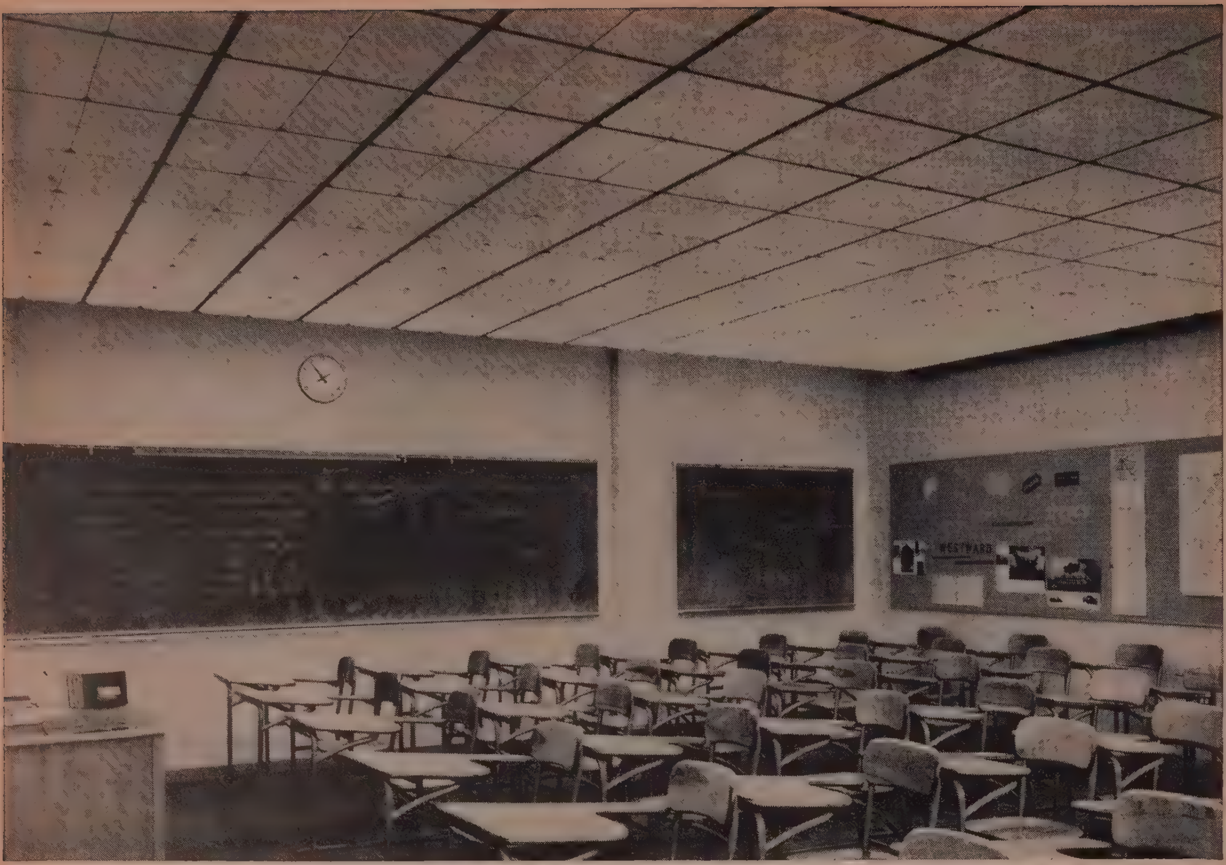
Competitive bidding on electrical work is, no doubt, a useful device in the hands of experienced architects and engineers. Based upon uniform plans and specifications with close control of the quality of materials and workmanship, the bids received can be expertly appraised and the finished work inspected for compliance. For the average home owner to attempt such a sophisticated process, without professional help, serves no useful purpose whatever.

Electrical modernization in homes consists of relatively small individual projects. It is no service to either the customer or the industry to load such jobs with the high sales and overhead costs necessary to support the waste of multiple estimates and the fruitless sales efforts of several contractors engaged in costly and pointless bidding contests.

The simple answer is, as we see it, the use by electrical contractors of plain, open, unit price lists keyed to appropriate estimating forms. Take the mystery out of price at the customer's level, give him a chance to assemble, however inexpertly, the total cost of his own job and sales efforts can be constructively devoted to helping him select the best installation to serve his needs and his pocketbook. Open price lists inspire confidence, discourage shopping, and facilitate closing on the initial sales call.

Many electrical contractors may feel uneasy about putting out prices for all the world, including their competitors, to see. They also point out that unit costs in modernization work are widely variable and that each job should be priced according to the specific conditions encountered. We do not deny that unit prices based upon average costs and conditions present some element of risk on particular jobs. However, over a number of jobs the variables inevitably balance out. And, whatever the difficulties, the overwhelming weight of modern merchandising experience favors open, published prices.

Wm. T. Stuart



SCHOOL STAFF ENTHUSIASTIC! Shadow-free light, the equivalent of soft daylight, achieved at low cost with translucent ceiling. (Min. 50 f.c. uniform intensity, max. brightness ratio under 3:1.) All structural members concealed. Nearly all rooms in the De Anza High School, El Sobrante, Calif., rely entirely on this lighting. Designed by John Carl Warnecke, AIA. "Acousti-Lux" panels and suspension system by the Celotex Corporation, Chicago, Ill.

Lighted by translucent ceiling...

This classroom needs no windows!

Night or day, cloudy or sunny, this classroom is evenly lighted. No problems of balancing daylight against illumination . . . no dark shadows—a more cheerful atmosphere . . . and figures indicate operating costs lower than many other systems! Translucent ceilings made with BAKELITE Brand Rigid Vinyl Sheet give complete control over lighting characteristics—and can help acoustically, too.

NOW . . . HIGH IMPACT RESISTANCE! BAKELITE rigid vinyl sheet is now available with *new high impact qualities* giving extra resistance to the hard knocks, the wear and tear of installation and maintenance. It resists cracking and warping . . . is normally unaffected by moisture or detergents. The lightweight panels are easy to install or remove, and to maintain. They are highly resistant to discoloration caused by ultraviolet light.

New lighting designs, renovations—they will look better, serve longer when you install luminous ceilings made with *high-impact* BAKELITE rigid vinyl sheet. For more information, write Dept. BB-41, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

UNION
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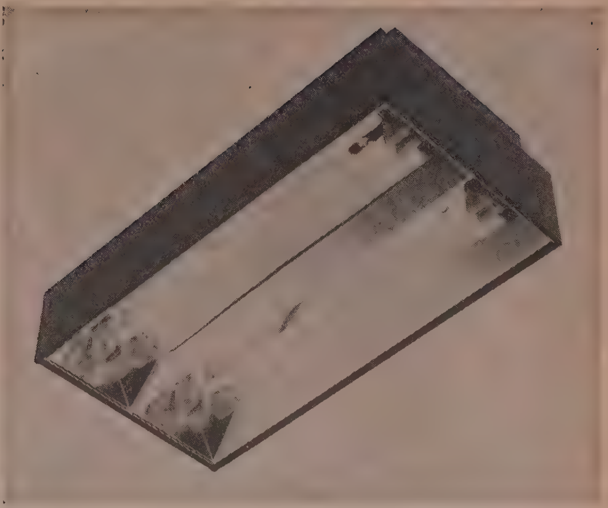


BASIC HEATING UNIT used in many of the installations noted. Standard design for T-3 "heat and light" lamps is made for one to three lamps.

Chicago Points Way to

Infrared Comfort Heating of Open Areas

as a new electrical installation market for contractor consideration. Quartz infrared tubes and lamps permit controlled application of heat and light with simple fixtures.

APPLICATION of quartz infrared heating to outdoor areas and large, poorly insulated indoor areas is opening up a new market for electric heating in the Chicago area. Long recognized as an efficient industrial process heating medium for baking, drying, preheating, curing, etc., infrared electrical heating is now coming out in the open. Electric heating applications formerly considered fantastic are becoming practical, economic realities. So far, only the surface of a sizable market potential is being scratched. It is wide open for conscientious, well-engineered development.

A number of factors have contributed to this significant breakthrough. Among them are:

1. Infrared radiant energy's inherent characteristic of heating people and objects rather than the surrounding air. This permits "comfort heating" in large outdoor and indoor areas previously considered too costly or impractical.

2. Adaptability of the long, thin, quartz tube infrared radiant energy source to fixtures with reflectors designed to direct or concentrate the heat where desired. This permits a degree of heat control similar to luminaire control of illumination.

3. Perfection, some five years ago, of the tubular quartz infrared "lamp," which provides from six to eight lumens of light per watt of lamp in addition to its normal output of 100 watts of heat per inch of lighted lamp. At full-voltage, these lamps operate at a filament temperature in excess of 4000°F,

permitting higher mounting heights than practicable with conventional quartz tubes operating in the 1400°F to 1800°F range. This combination heat and light source is desirable in many applications.

4. Renewed interest of manufacturers in designing and producing fixtures for both the tubes and lamps.

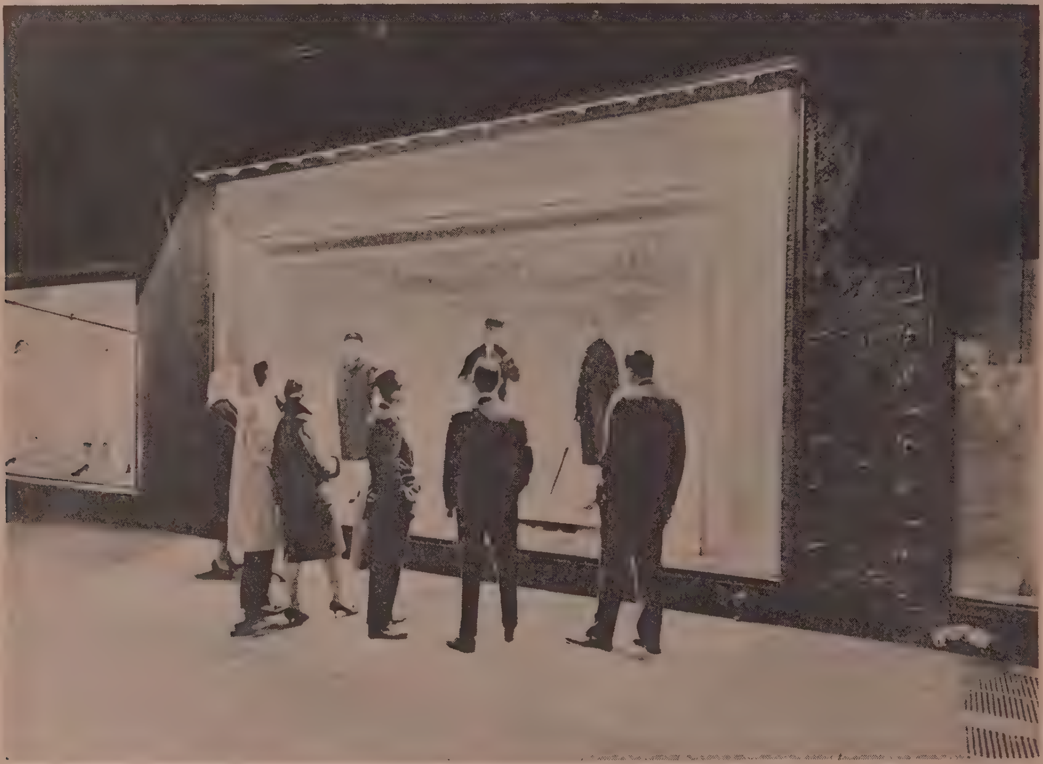
5. Increased interest of utilities seeking additional winter load to balance summer air-conditioning loads. Heavy commercial air-conditioning customers present a natural ready market for a number of outdoor comfort heating applications. Among them are show-window and pavement ice melting, building entrances, outdoor passageways, and truck loading docks.

6. Earnest collaboration of manufacturers, utilities, engineers and contractors in the carefully-engineered development of this market.

Chicago is emerging as a healthy example of what this brand of cooperation can do. Through the engineering and sales collaboration of the Commonwealth Edison Co., the utility, the lamp manufacturers, the makers of the special fixtures and electrical contractors (installation), numerous comfort heating systems have been designed to meet specific use requirements. Other manufacturers are promoting similar systems. Some of the permanent installations have attained the status of "firsts" in this new market. Others are of unquestionable pioneering nature. Reports indicate all are highly successful with exceptionally encouraging customer satisfaction.

Indicative of the broad scope of this market are the following representative Chicago installations.

Show Windows



OUTDOOR SHOW-WINDOW heating at Carson, Pirie, Scott & Co., Chicago. Each of ten windows has 11 to 13 kw of quartz infrared lamps. Note effective coverage of heat and light rays on sidewalk.

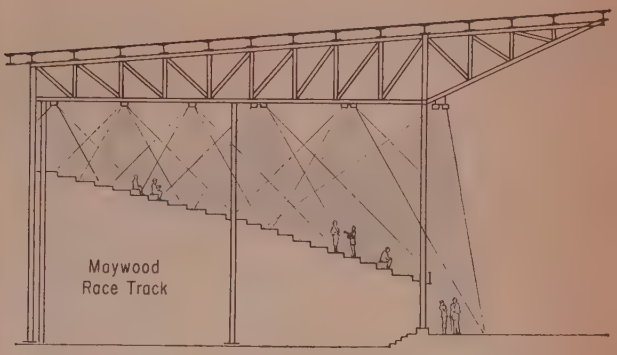
Carson, Pirie, Scott & Company warms window-shoppers and passers-by plus the sidewalk in front of 10 display windows facing State Street. The country's first permanent outdoor installation of quartz infrared heat lamps for shopper comfort uses a total of 123 1,000-watt, T-3 tubular quartz lamps in a specially designed line of reflectors housing 11 to 13 lamps, depending on window length. Lamps are about ⅜ in. diameter and 13 in. long and are mounted in a single row.

Reflectors on building wall above windows beam heat rays slightly away from store front to keep sidewalk warm and dry 6 to 8 ft out from windows. Installation produces about 80 watts per sq ft of heat energy at sidewalk. Light level in front of windows is more than 500 footcandles.

Normally, the infrared lamps are operated at rated 208 volts. During extreme weather conditions, the lamps can be operated at 250 volts through a step-up transformer in the heating circuit. This increases heat output of the lamps by about one-third. The system involved running a new 600-amp feeder from the store switchboard to a central point where circuit breaker protected branches serve each window. Installation was by Hohman and Hill, Inc., Chicago electrical contractor.

Racetrack Grandstand

RACE TRACK GRANDSTAND at Chicago's Maywood Park has 1,026 kw of quartz lamps providing about 30 watts of heat per sq ft at seating level and 70 to 80 footcandles of lighting covering 21,000 sq ft area. Single and dual fixtures contain two to four 3,800-watt lamps.



DISTRIBUTION PATTERN of heat and light provided by fixture reflectors at Maywood Park grandstand. Note controlled distribution of asymmetric reflectors in front row.

Nearly 4600 fans seated in the 21,000-sq-ft grandstand at Chicago's Maywood Park Track can watch trotting races in perfect comfort during the chill evenings of early spring and late fall. A recently installed quartz infrared lamp electric heating system provides approximately 30 watts of radiant heat per sq ft at seating level plus 70 to 80 footcandles of illumination to facilitate reading of the racing program. In addition to having the country's first permanent grandstand infrared lamp heating system, Maywood now is reported to have the nation's best-heated and best-lighted stands for its patrons.

This pioneering installation used a total of 270 pencil-thin, 3,800-watt, T-3 tubular quartz infrared lamps housed in reflectors designed especially for this project. Fixtures are in six rows suspended from the roof trusses and spaced for even distribution of light and heat. The front three rows are four-lamp units with mounting heights varying up to 33 ft. The back rows of two-lamp units have a 14-ft minimum mounting height. Specially designed asymmetric reflectors in the front row prevent excessive "spill" of radiant heat out of the grandstand area.

The complete system was designed and installed by Crosstown Electric Company of Chicago. It is operated by a pushbutton control panel in the track tower where the operator can turn on the lamps in any or all four sections of the grandstand to accommodate occupancy. The system can be operated at full or half intensity to match temperature conditions.

A new, 1,500-kva utility substation supplies power for the new heating system and other uses.

SUGGESTED APPLICATIONS FOR INFRARED COMFORT HEATING

OUTDOOR

- Airport Boarding Areas
- Building Entrances
- Drive-In Restaurants
- Drive-In Banks
- Gas Stations
- Loading Platforms
- Outdoor Construction
- Outdoor Cafes
- Patios
- Railroad Loading Platforms
- Shopping Centers
- Stadium Grandstands
- Swimming Pools
- Theatre Marquees
- Transit Platforms
- Walkways Between Buildings

INDOOR

- Aircraft Hangars
- Airport Baggage Areas
- Auditoriums
- Building Foyers
- Bridge Towers
- Filtration Plants
- Garages
- Gate Houses
- Gymnasiums
- Health Centers
- Locker Rooms
- Machine Shops
- Steel Warehouses
- Ticket Booths

Airline Baggage Area

AIRPORT BAGGAGE AREA in Continental Airline's terminal facilities at Chicago's O'Hare International Airport is heated by 28 units, each containing two 1,000-watt quartz infrared heating tubes (no light component). Rows of heating fixtures are ceiling suspended between fluorescent lighting units.

A total of 28 ceiling-suspended infrared heating units provide comfortable warmth within Continental Airline's new baggage check-in and claim area at Chicago's O'Hare International Airport. Each fixture contains two 1,000-watt quartz infrared tubes which provide heat but no light. Ceiling-mounted conventional fluorescent fixtures provide good general lighting.

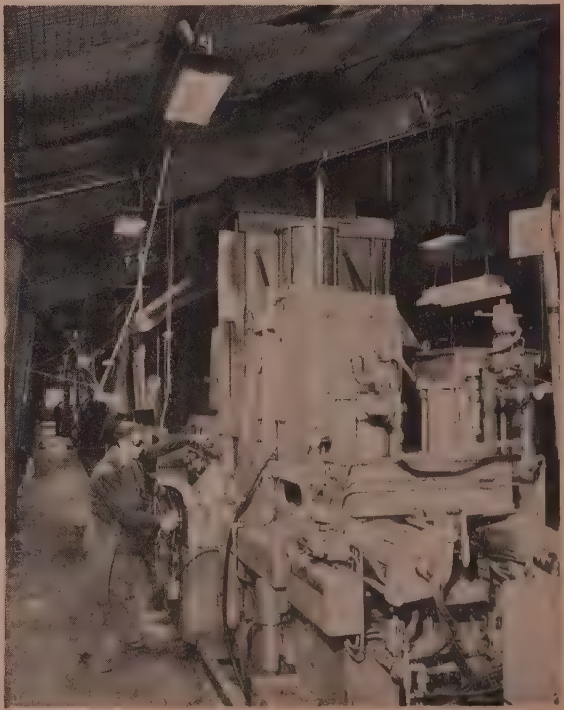
No other type of heating is used. The infrared units are designed and spaced to cover the entire area with reflected infrared heat. People and surfaces are warmed directly even though ambient air temperatures remain low.

The system, installed by the B-H Electric Co., Chicago, has control flexibility permitting operation at half or full load depending upon activity in the area.

Industrial Plant Area

Tubular quartz infrared heat lamps solved the problem of employee heat comfort in the 200-ft long, prefabricated, poorly insulated rail welding building at Matisa Railweld, Inc., Chicago. The structure houses a line of machinery used to weld 36- to 39-ft railroad track sections into continuous lengths exceeding 1,200 ft. Comfort heating is needed only at the work stations where operators are located.

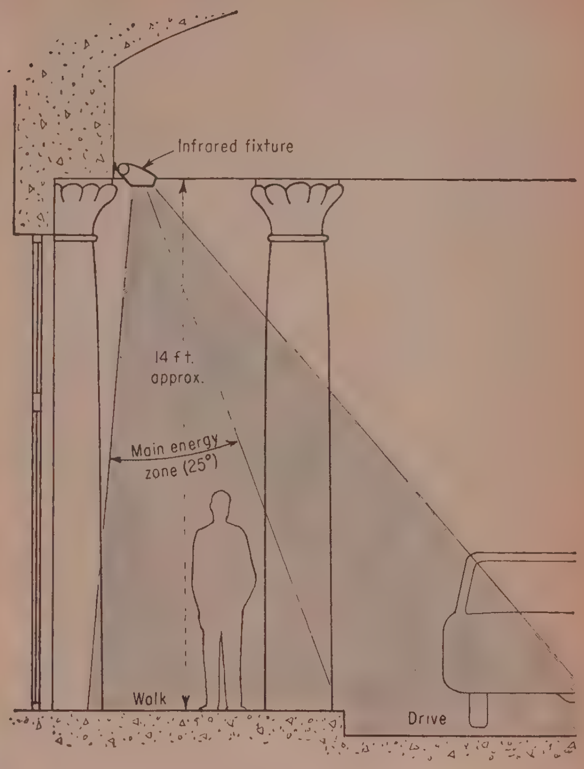
Twelve infrared heating fixtures were installed by Crescent Engineering Company, Chicago, along both sides of the rail welding line. Each fixture contains two 1,600-watt T-3 lamps. Spacing varies according to work station location. Most of the units slide along a roof-suspended messenger cable so operators can move them as they change work positions. There is no other heat source in the building.



OPERATORS ARE WARMED by 3,200-watt infrared fixtures suspended above work stations along rail-welding line at Matisa Railweld, Inc., Chicago. Most of the 12 units installed slide along messenger-cable support for flexible positioning. Each contains two 1,600-watt quartz lamps.

Hotel Entrance

ENTRANCE PORTICO at Chicago's Edgewater Beach Hotel has line of 12 1,000-watt infrared heat lamps that blends with architecture. Street side has additional fixtures that combine to provide average of 60 watts of heat per sq ft and better than 200 footcandles of lighting.



SPECIALLY DESIGNED fixture for Edgewater Beach Hotel portico concentrates most of the heat energy on walk with enough spill-over to keep drive dry.

Arriving and departing guests at Chicago's Edgewater Beach Hotel are made comfortably warm during cold weather by infrared heat lamps installed under the main portico. A total of 24 T-3 tubular quartz infrared lamps provide from 40 to 75 watts of radiant heat per sq ft at pedestrian level and from 160 to 300 footcandles of illumination in the 20- by 20-ft entrance area.

Above the entrance door is a line of fixtures containing 12 1,000-watt lamps. On the opposite side of the portico are six fixtures, each containing two 1,600-watt lamps. In addition to guest comfort and light, the installation thaws ice and snow from the entranceway and keeps the walk and drive dry during inclement weather. Hotel power capacity normally used for summer air conditioning operates the lamps.

OPPORTUNITIES UNLIMITED

These are among the precedent-setting comfort heating installations that have sparked this market in the Chicago area. Others already in or under design consideration include: utility training and maintenance centers; a heavy equipment storage building; railroad repair shops; a brick manufacturing plant; building entrances; bridge towers; outdoor transit passenger platforms; loading docks. The list of possible applications is long (see accompanying table, page 91).

Development of this new facet of the electrical heating market is gaining momentum. The electrical contractor is an important factor. For him it represents much more than installing heating units. These are high-capacity systems requiring heavy-duty feeders and circuits plus well-designed control for operating flexibility. It means more wiring business for him and an opportunity to solve a knotty customer problem electrically. The potential exists just waiting for intelligent investigation and promotion. It is a market no electrical contractor can afford to ignore in his daily quest for new business opportunities.

AIR CONDITIONING and heat pump operations are controlled by weather station and low voltage zone controls. Raceway carries feeders from which circuits are tapped through surface mounted breakers.

PERIMETER LIGHTING uses valance, open above and below, on wall brackets.

Sub-feeder System

Serves Gold Medallion Home

Connecticut all-electric home has surface raceway enclosed feeders with CB controlled branch circuit taps on basement ceiling.

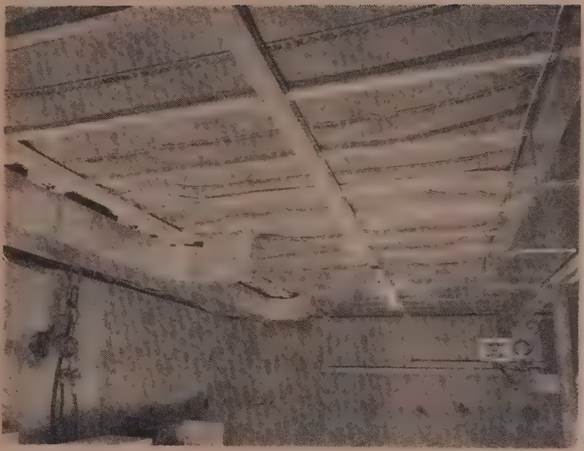
By W. T. Stuart

A NOVEL adaptation of industrial feeder practice employing surface-raceway-enclosed, high-capacity feeders to branch circuit taps located along the length of the feeder is used in a new home built for William E. Parks in Plantsville, Conn. Among the other electrical features of the all-electric home are baseboard multi-outlet assemblies and wireways, perimeter lighting, low-voltage switching, and a central heat pump installation.

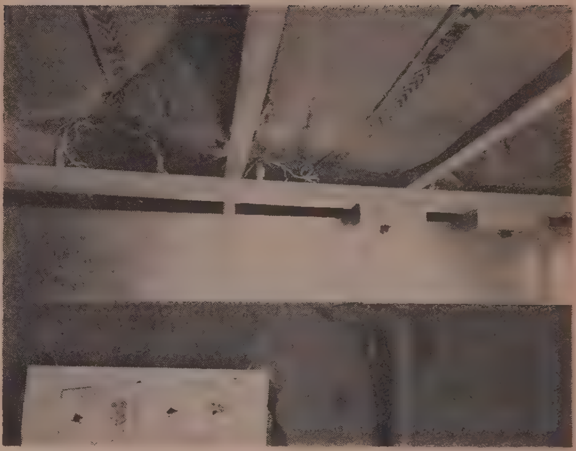
The service entrance panelboard, fed by a 200-amp underground service, is located at one end of the L shaped full basement under the 7-room ranch type house. Six double pole 50-amp breakers are provided. No. 6, 3-wire feeders are extended approximately two-thirds of the length of the basement ceiling in three surface metal raceways.

The feeders run directly under or closely adjacent to fixed appliance locations. Surface boxes, holding single or paired branch circuit breakers, are mounted on the under surface of the raceways at the branch circuit tap and provide branch circuit overcurrent protection.

Short runs of armored cable ex-



FEEDERS IN SURFACE RACEWAYS extend along basement ceiling. Branch circuits are tapped off directly under appliances in kitchen above.



CLOSE-UP of branch circuit breakers surface mounted on feeder raceway. Relays in top of raceway control switched receptacles in baseboards above.

tend upward from the top of the feeder raceways to baseboard raceways, outlets, or appliances above. For ceiling lighting, branch circuits are carried up to attic junction boxes in EMT.

As in industrial installations, this system provides very short, low impedance, branch circuit home runs. Loading on the feeders is so diversified, that under normal conditions they are operating at only a fraction of available capacity resulting in almost negligible voltage drop and minimum dip on motor starts. The full feeder-length accessibility of the raceway also makes the generous use of individual branch circuits readily practical and convenient.

Plug receptacle connections in the living areas are provided through electrical baseboards. Duplex receptacles in the upper portion are spaced on 30-in. centers with one hot and one switched opening. The lower portion of the baseboard is a wireway for branch circuits and switch legs.

Among the lighting methods used is a perimeter valance, open above and below, with fluorescent lighting strips providing indirect and wall-washing general lighting. Flush accent lights and pin spots are used in the living and dining areas. One of the baths is equipped with a full translighted ceiling in addition to mirror lights.

In addition to the full complement of electric kitchen and laundry appliances, the home is heated and cooled by a combination air conditioner and heat pump. Cooling capacity is 35,000 Btuh and heating capacity is 65,000 Btuh. The equipment is the air-to-air type with two sections; one located in the basement and the other outdoors at the rear of the house.

Temperature in sleeping and living areas are separately zoned and controlled by modulating dampers. The entire cooling and heating system is automatically controlled by an indoor-outdoor weather station.

The wiring layout was designed by engineers of the Wiremold Co., and the electrical system was installed by Shea Electric Co.

UNDERCOUNTER multi-outlet strip provides handy plug-in for portable electric appliances.

● *ESTIMATING FORUM—I*

Volume Is No Criterion Of Profits

By **Ray Ashley**, *Research and Consulting Engineer, Oak Park, Ill.*

STATEMENT:

The annual sales of two electrical contractors "A" and "B" were $427,800 and $406,100 respectively. A's volume was $21,700 greater than B's. The aggregate base cost of $300,000 (material purchase price and payroll) was the same for both. However, the base costs of the individual contracts comprising total sales varied considerably. A's average was $3,000 compared to $10,000 for B. The work of both contractors was essentially of the same nature and was obtained against competition.

QUESTION:

Did contractor A make more money than contractor B?

ANSWER:

No. The additional cost of supplying the smaller installations more than offset what "A" gained by having the larger volume. In fact, "B" earned $5,150 more than "A."

DISCUSSION:

Contractor A had 100 orders (300,000 ÷ 3,000) whereas contractor B had only 30 orders (300,000 ÷ 10,000). There was a great difference in the amount of help needed for estimating, engineering, layout, bookkeeping and billing the larger number of jobs. Naturally, A's operating costs were substantially more than B's.

The accompanying estimates show the experienced costs of the two contractors.

At times, contractors figure work and accept contracts as they come without giving too much thought to the considerable difference in the operating costs of various size projects. However, once their books are filled with small orders, they soon learn that volume per dollar of operating costs must go down.

Throughout this study keep this in mind: each of these contractors has work of similar nature obtained under competitive conditions. A future article will discuss the reasons why unsolicited orders from regular customers are entitled to lower operating cost markups.

ESTIMATED COSTS

CONTRACTOR A			
Base cost of contracts (material purchase, payroll)			$300,000
Estimating and engineering	4%		12,000
Other job costs (tools, supervision, etc.)	6%		18,000
Total job cost			$330,000
Overhead and service costs	20%		66,000
Complete installation cost			$396,000
A's total sales		$427,800	
A's total costs		396,000	
Net Gain		$31,800	
CONTRACTOR B			
Base cost of contracts (material purchase, payroll)			$300,000
Estimating and engineering	3%		9,000
Other job costs (tools, supervision, etc.)	4%		12,000
Total job cost			$321,000
Overhead and service costs	15%		48,150
Complete installation costs			$369,150
B's total sales		$406,100	
B's total costs		369,150	
Net Gain		$36,950	

Note: Percentages used were taken from cost studies.

Wiring an
Aluminum Showcase

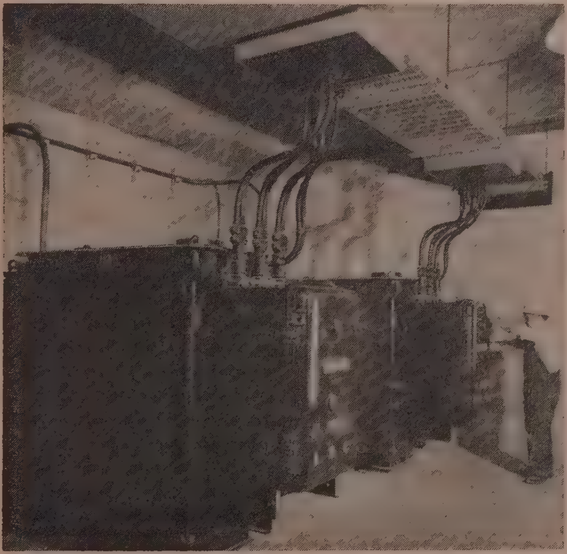
Kaiser's new Oakland, Calif., headquarters features a high capacity secondary network for a 460/265-volt system. The project was designed by Walton Becket and Associates, architects and engineers. Foothill Electric Corp. was the electrical contractor.

CURVED FACADE of Kaiser Building towers 390 ft above shores of Oakland's Lake Merritt. Gold aluminum alloy panels and broad horizontal bands of tinted glass are set in framework of natural-finished mullions and brad column and beam fascia, while end walls of precast concrete are faced with white dolomite aggregate. With nearly a million sq ft of floor area, it becomes the largest office building west of Chicago.

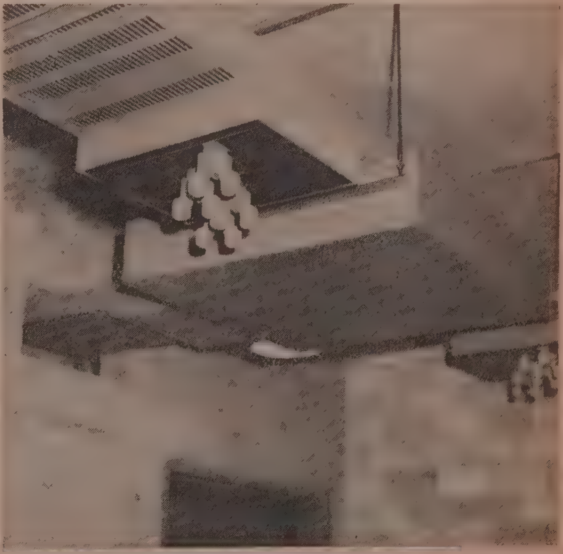
KAISER Industries' impressive new international headquarters office building in Oakland, Calif., more than double the size of any building in the area, is equipped with a practically all-aluminum electrical system including over 370 miles of aluminum wire and cable and 16 tons of aluminum busway and conduit.

A crescent-shaped floor plan required a new cellular-floor header duct with angular connection sections to follow the curve of the building outline. A three-story deep basement affected the location of underground service entrances, the main switchgear, and the central switchboard.

Structural details directly affected electrical plans, since the curved floor plan created variations in both lighting and underfloor distribution circuit patterns. The deep



TWO OF TEN 1000-kva 12-kv/460/265-volt primary transformers. Secondaries connect with 4000-amp ventilated aluminum busway serving separate service taps and high-IC fused switches related to three sections of main switchboard. Vaults are located on second of three basement levels.



DOUBLE-SOCKET double-bolt lugs are used to twin 750-MCM transformer-secondary leads (two per phase) prior to their connection with grouped phase bars of low-reactance interleaved bus structure. Panels surrounding lugs are of ebony-asbestos. Branch duct serves one of the three main switchboard sections.

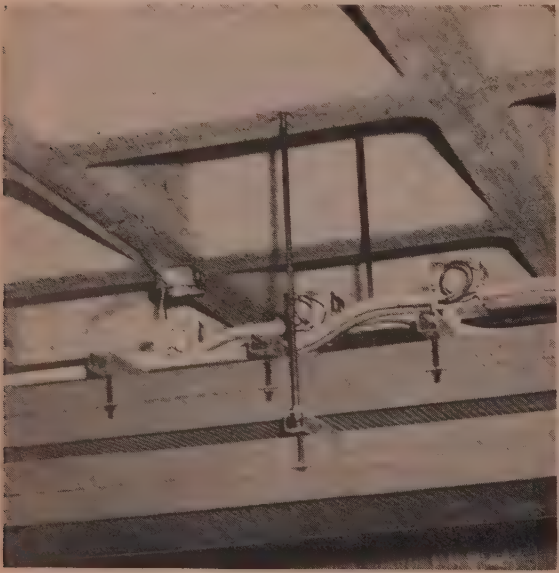
INSTALLATION of busway was facilitated by battery-operated forklift that supported sections firmly while journeyman secured trapeze hangers, then bolt-connected and tape-insulated related bars of adjoining busway sections.

MAIN SWITCHBOARD has three sections, each served through separate low-reactance feeder duct, separate high-IC fused switch, and common 4000-amp bus structure obtaining power from ten 1000-kva primary transformers. Eight sub-feeders serving various building facilities are equipped with electrically operated draw-out air breakers.

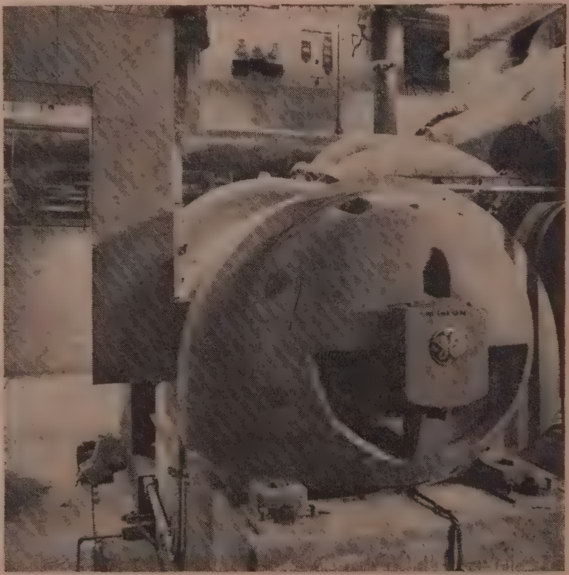
triple-basement design directly influenced detailing of underground service entrances and primary transformer vaults located in the first basement; main switchgear in the second basement: a central plant switchboard; three motor control centers; and an equal number of refrigeration compressors at the third-basement level, plus sections of 14 separate busway installations related to these three electrically critical areas.

Primary power is obtained from a 12-kv 3-phase delta underground utility network. Separate service connections through externally operated non-fused disconnects serve ten 1000-kva transformers that step voltage to 460/265 wye, the building's basic distribution voltage.

The transformer secondaries, equipped with network protectors, are connected to a common 4000-



BUSWAY SUSPENSION was achieved by several methods, one pictured above consisting of rods and trapeze hangers supporting upper-of-two tiered ducts, carriage bolts then extending down to support lower duct while additional cross-channels support local branch conduits placed atop the main assembly.



COMPRESSOR MOTOR (one of three) is controlled through reduced-voltage starter of autotransformer type. Note massive concrete pedestal, grounding cable, auxiliary gutter with removable cover plates to facilitate wiring. Motor feeder is powered through electrically opened drawout CB located at main switchboard seen on balcony.

amp ventilated low-reactance aluminum busway structure. Flexible connections between transformers and bus are 750MCM RHRW copper cables, two per phase, paralleled in double-socket, double-bolt lugs at the grouped phase bars of the busway assembly.

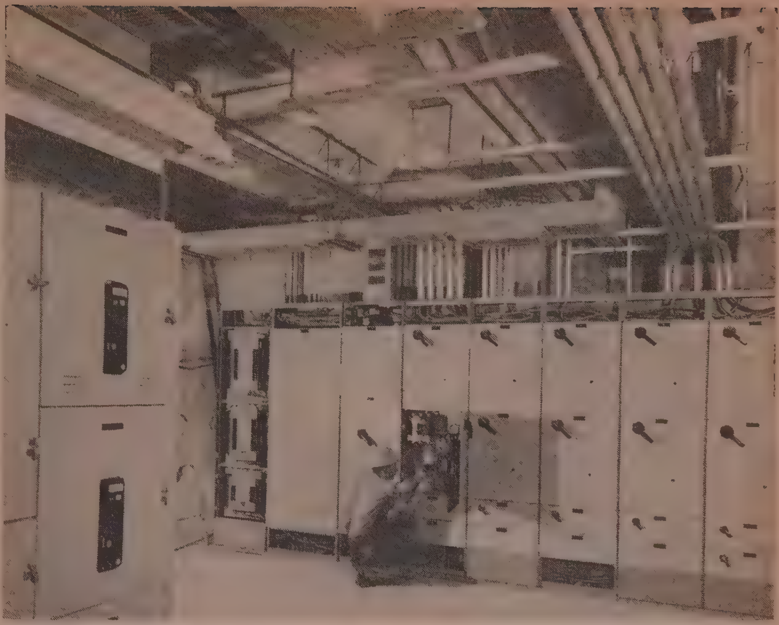
From the common 4000-amp busway, three taps are made through the high-interrupting-capacity (200,000-amp) fused switches, extending via additional ventilated busways to three separate sections of the main switchboard.

Eight busway feeders (sized from 1000-amp 3-wire to 2500-amp 4-wire) radiate from this main board controlled by electrically operated drawout-type air breakers. Of three 3-wire feeders, two serve 1000-hp compressor motors. The third feeds the building's 18 elevators plus a motor-control center located in the penthouse.

The five 4-wire feeders serve three additional motor-control centers in the third basement, 68 electrical closets on upper floors, a series of separately metered lower-floor shopping-center tenants, also (through a current-limiting busway) a central plant switchboard handling building cooling, heating, ventilation, general utilities, emergency lighting, and an additional (500-hp) refrigeration compressor.

Typical upper floors obtain power from the two 2500-amp 4-wire (full neutral) busways just mentioned, each duct serving an electrical closet on every floor through two 200-amp fused switches. One switch serves a 460-volt distribution panel, the other (through a dry-type low-decibel local transformer) a 120/208-volt panel. Transformers on typical floors have 30-kva capacities, although special requirements on some floors (such as one containing an all-electric kitchen) require transformers rated as high as 500 kva.

In addition to the two busways and closets located at either end of the structure, three other risers ex-



MOTOR CONTROL CENTER (one of five) obtains power through interleaved bus structure and 800-amp fused switch. Electrician is seen connecting 1 of 10 motor starters controlling condensate and chilled-water pumps in 40-50-hp range. This MCC also includes magnetic across-the-line starters for air-compressors, oil and purge pumps.

TYPICAL ELECTRIC CLOSET contains two fused switches tapped to vertical 2500-amp 4-watt (full neutral) ventilated busway, a dry-type low-decimal transformer (suspended from ceiling); two distribution panels for 460/265- and 120/208-volt service plus (in some instances) contactor and dimmers.

CLOSEUP of special 12-in.-wide header shows flanged construction of base channel and square cover plates secured to channel shoulders by small screws. Design permits full-width continuous access to headers to facilitate wiring in any or all sections of this high-capacity raceway.

DIAMOND CORE DRILLS were used to cut through finished concrete floor-slab and underlying steel cells wherever floor outlets were to be positioned.

SLIGHT CURVATURE of building necessitated creation of fan-shaped junction sections which were positioned periodically along header runs to obtain desired arc. Cellular floor plan also contains intermittent tapered members so that raceways remain at right angles to curved building centerline.

SPECIAL HEADER DUCTS, large-diameter junction boxes and sweeping sections that connect with distribution panels were used to provide adequate wiring capacity for extensive power, telephone and intercom systems. Note blocking and strapping of ducts to forms prior to pour.

tend upwards through a shaft located at the center of the north (rear) side. Of these three, one is the 1000-amp 3-wire elevator busway mentioned previously. A second 1000-amp (4-wire) busway serves lighting, while the third (500MCM) feeder serves all emergency facilities.

Emergency panels are located at varying floor intervals, depending upon load concentrations. Lighting closets (containing both 120/208- and 460/265-volt panels) are located every third floor, with subfeeders extending up and down to other panels, junction boxes and/or contactors located at intervening floor levels. In general, lighting is controlled through contactors and closet distribution panels which are inaccessible to general personnel (rather than through local switching stations), since it was decided to leave lights burning far into the night for spectacular effect.

Cellular Floor Variations

Since the elongated 420- by 62-ft plot-plan of this building describes a slight arc, the cellular floors contain tapered sections which are spaced intermittently to obtain desired floor curvature. This cellular pattern, in turn, required special fan-shaped headerduct sections to maintain a right-angle configuration between cells and headers.

As noted in accompanying illustrations, header ducts are of two types, a standard 7-in.-wide steel duct for power circuits, and a 12-in. header which was specially designed for this installation to provide sufficient wiring capacity for the extensive telephone and intercommunication systems. Due to the satisfactory results of this initial application, this special duct has since been added to the manufacturer's standard line.

Design of this header is unique in that it is covered by a continuous series of flat square plates, rather than by a few round or square junction collars and covers spaced at intervals along an otherwise totally enclosed feeder raceway. This arrangement of adjacent, removable plates provides access to any section of duct or to any cell in the entire floor system. And, when bulk wiring is in progress, all plates may be removed so as to open a header for its full length, thereby facilitating wiring between numerous floor cells and related distribution panels located in nearby walls or electric closets.

STANDARD STEEL header duct (foreground), with circular access plates positioned above related floor cells, were used for power distribution. Note reinforcing mesh placed above duct to give added strength to subsequently-poured slab. Continuous-access special header is seen at rear.

For installing service outlets and floor receptacles after finished slabs have been poured, diamond core drills were adapted to cut through to the cells. This detail was accomplished by a 2-man crew, one worker leveling and steadying the drill, the other directing a stream of water into the hole-surrounding collar for drill-cooling and lubrication purposes, and both men exerting simultaneous pressure upon a pair of lowering levers.

Since header ducts, floor cells, collar inserts, floor receptacles and reinforcing mesh of finished concrete slabs are bonded together and to the structural steel skeleton of the building as well, grounding of all non-current-carrying metal components is unusually thorough.

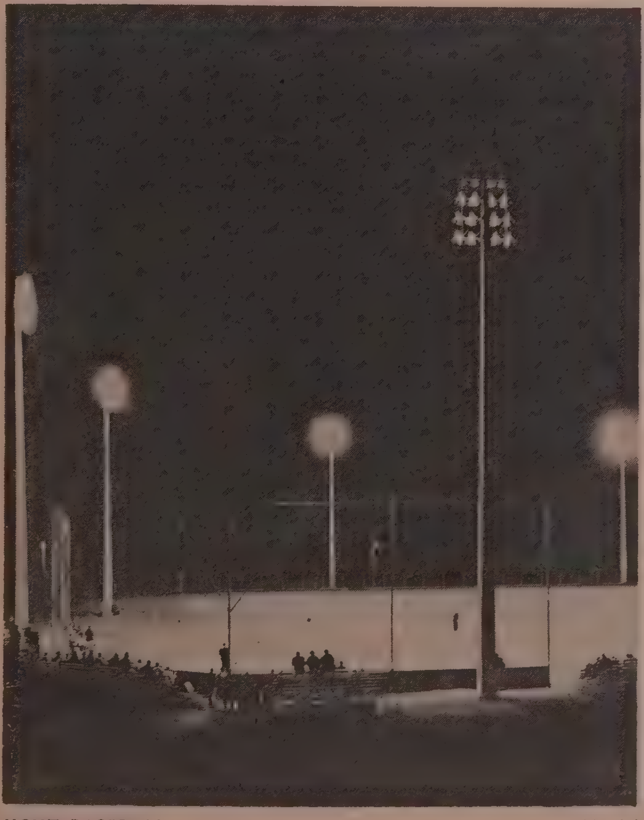
Designed to serve 4000 employees of more than 60 domestic and foreign Kaiser companies and subsidiaries, the building contains not only office space, lobbies and service areas, but an electronic computer section, a medical clinic for employees, an auditorium and cafeteria, a pneumatic tube system that automatically carries wire messages between office floors and the communications center, two pushbutton conveyor mail delivery systems, and numerous lower-level shops and service facilities. Totaling nearly a million sq ft of floor area within the main building, with an additional 714,000 sq ft in related shops and a 5-level parking structure, this modern commercial development more than doubles the size of any other similar building in the San Francisco Bay area.

Support of Floodlights by

Pre-Stressed Concrete Standards

Is Sports Lighting Innovation

Towers weighing 22,000 lb each were selected for lighting installation at Heidelberg Park baseball diamond, Tacoma, Wash., for long range economy, durability and architectural beauty. Lighting system was designed by Paul Marten, electrical engineer, and installed by Carl T. Madsen, electrical contractors.



NIGHT BASEBALL is a pleasure for players and spectators at Heidelberg Park, Tacoma, Wash., where 144 floodlights, each using 1500-watt lamps, direct their 6-million lumens to the playing area.

A UNIQUE floodlighting installation, using pre-stressed concrete standards, has given Tacoma, Wash., one of the best lighted city baseball fields in the Northwest.

The installation, lighted to well above the minimum requirements for semi-pro and municipal fields, is illuminated by ten banks of Crouse-Hinds Type FLA floodlights placed on 80-ft concrete obelisks which weigh some 22,000 lb each.

The tapered concrete poles, which blend well with the natural, rugged terrain of the Northwest, were selected because of their long-range economy, durability and architectural beauty.

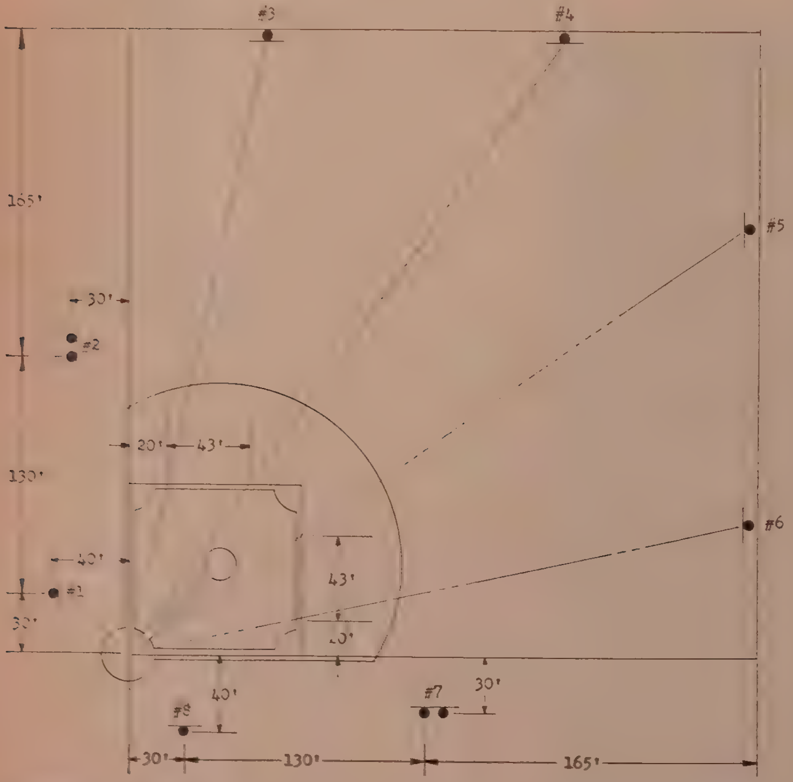
They require no painting, have a test compression strength of 10,000 lb per square inch, and are erected on spread concrete footings to withstand 90-mile-an-hour winds. To add materially to their sleek appearance, the standards measure 28 in. square at the base and taper 1 in. every 4 ft to the top.

As this was the first reported case of pre-stressed concrete standards being used on a baseball diamond in the United States, several novel engineering considerations were presented.

Concrete Technology Corp. of Tacoma was called upon to provide standards that were not affected by moisture absorption and thus could withstand freezing conditions without flaking or chipping. Careful consideration was also given to transportation and erection problems to keep stresses in the poles well within permissible limits.

As the poles are tapered, a special crossarm system was also devised. The 1½-in. IPS aluminum heavy wall tubing crossarms were cross-welded into one structure, and then the completed unit was

CONCRETE STANDARDS were used to support floodlights, and their tall, clean lines blend well with the rugged terrain of the Northwest. This is the first installation of pre-stressed concrete standards for this purpose in this country.



LIGHTING LAYOUT shows plot plan of diamond, and exact location of the ten floodlight poles, at eight pole locations, with respect to the diamond and playing field. Two poles were installed at locations 2 and 7. The six poles at locations 1, 2, 7 and 8 each support 16 floodlights, while the four poles at the outfield locations 3, 4, 5 and 6 each support 12 floodlights.

clamped to the pole at each crossarm location.

Flat 4- by 4-in. aluminum pads welded onto the crossarms provide bases for the floodlights. A total of 144 general-purpose incandescent floodlights were selected for the job. Each floodlight was designed for use with a 1500-watt PS-52, 33,000-lumen lamp, and both 50° and 80° beam-spread units were used.

Each infield pole has four crossarms, and four floodlights are located on each arm for a total of 16 floodlights per pole. Outfield poles have 12 units each. The floodlights were adjusted while the crossarm unit was on the ground, according to quadrant settings provided by Crouse-Hinds illumination engineers.

Because of the exactness of the preforming job, it was possible to erect the poles in a perfectly vertical position, with the aid of two transits, so that no minor adjustments were required when the floodlights were in their final position.

Carl T. Madsen, Inc., electrical contractors, raised the completed units by using two 20-ton cranes, each having a 90-ft boom. The poles are of a hollow taper design with a 4-in. wall up to approximately 60-ft. In this space run both primary and secondary conductors. The upper 20 ft of the pole are solid and the wiring is run in conduit. Location of the poles with respect to the diamond is shown in the accompanying plot plan of the field.

The completed installation illuminates the field to a level of 42 footcandles at home plate, 36 footcandles at the pitcher's mound and from 22 to 25 footcandles on the base paths. The level is 15 footcandles in the outfield while the location of poles and aiming of floodlights allow for a good cut-off just outside the sidelines.

Electrical Service

Heidelberg Park is serviced by a 4160-volt, 3-phase, 4-wire primary brought in from the local electrical utility substation approximately one mile away. There is no substation at the site, and the primary load is divided equally among the banks of floodlights.

Primary conductor is of No. 4, 5-kv direct burial copper with the hot conductor shielded and the neu-

ARCHITECTURAL BEAUTY of the pre-stressed concrete obelisks, each 80 ft tall and weighing approximately 22,000 lb, is highlighted in this photo showing the six infield standards adjacent to the diamond.

SECONDARY BREAKERS are controlled from a box at the base of each pole, which allows for individual switching of each bank of floodlights. Primary and secondary conductors are run concealed in the poles.

tral unshielded. One switch controls the primary source of power.

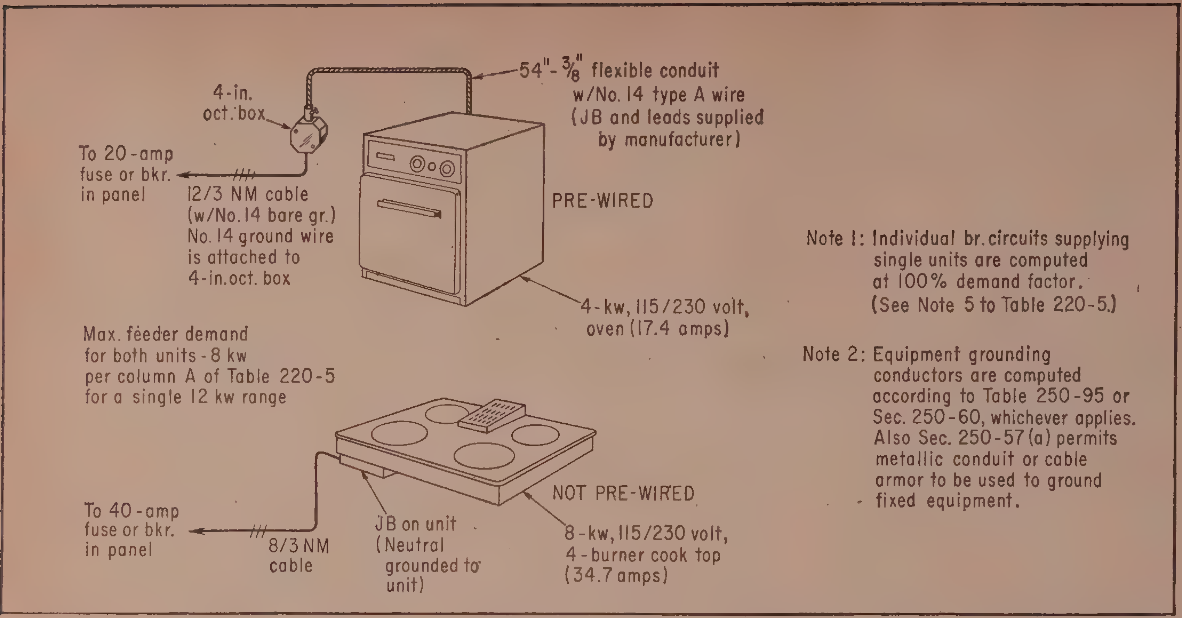
One transformer, with a secondary breaker, is mounted on each pole, approximately 18 ft above the ground. This switch is mechanically controlled from a box located on the pole within arm's reach of the custodian for disconnecting the secondary on any pole and thus the floodlights.

The secondary system is nominally 120 volts and measures 124 volts. All floodlight lamps for the system, which operate at an overvoltage of 10%, are of the PS-52 1500-watt, 115-volt, mogul base type. Cords running from the distribution panel to the floodlights are bundled and fastened to the structure with aluminum bands.

Maintenance

For maintenance, pole steps were installed from 6 ft below the bottom crossarm to facilitate working on the lower floodlights. The Tacoma Fire Department has volunteered to furnish truck and ladder equipment for maintenance work on the lamps, and provisions have been made so that boatswain's chair can be installed if it is needed in the future.

TWO CRANES were used to raise each 22,000-lb pole, complete with floodlights, into place. Floodlights were preset on ground, required no adjustments when elevated to final position.


54"-3/8" flexible conduit w/No. 14 type A wire (JB and leads supplied by manufacturer)
4-in. oct. box
To 20-amp fuse or bkr. in panel
12/3 NM cable (w/No. 14 bare gr.) No. 14 ground wire is attached to 4-in. oct. box
PRE-WIRED
4-kw, 115/230 volt, oven (17.4 amps)
Max. feeder demand for both units - 8 kw per column A of Table 220-5 for a single 12 kw range
NOT PRE-WIRED
To 40-amp fuse or bkr. in panel
8/3 NM cable
JB on unit (Neutral grounded to unit)
8-kw, 115/230 volt, 4-burner cook top (34.7 amps)

Note 1: Individual br. circuits supplying single units are computed at 100% demand factor. (See Note 5 to Table 220-5.)

Note 2: Equipment grounding conductors are computed according to Table 250-95 or Sec. 250-60, whichever applies. Also Sec. 250-57 (a) permits metallic conduit or cable armor to be used to ground fixed equipment.

FIG. 1—An 8-kw cook top is supplied by an individual No. 8 (40-amp) branch circuit, and a No. 12 (20-amp) branch circuit supplies a 4-kw oven. Such circuits are calculated on the basis of the nameplate rating of the appliance. In most instances individual branch circuits cost less than 50-amp, multi-outlet circuits for cooking and oven units. Other wiring details are shown in the sketch.

A roundup on methods of . . .

Wiring Built-In Cooking Appliances

By J. H. Watt

While the 1959 NEC has clarified the status of built-in cooking appliances, a number of problems such as demand factors, branch circuit classifications, junction box sizes, and methods of grounding remain unsolved.

COUNTER-MOUNTED cooking units and wall-mounted ovens have been with us for a long time. And so has the problem of how to wire them.

Until the recent adoption of the 1959 NEC, inspectors and contractors had little to go by except local code rulings on this subject. But in reviewing the new NEC rules for built-in cooking appliances, it is apparent that local rulings will continue to be made until several major problems are resolved.

Basic issues that still remain unanswered in the NEC are: 1) the proper method of computing branch circuit and feeder demands for cooking and oven units; 2) recognition of a 40-amp multi-outlet branch circuit for cooking appliances; and 3) methods of grounding units which are connected to 40- or 50-amp circuits.

The following "round up" points out the various step-by-step methods of wiring these units according to the NEC. And pertinent local code rulings are discussed and take over where the NEC leaves off. It is hoped that a thorough discussion of the problems will ferret out any inequities in the NEC and will result in subsequent code changes that provide sound methods of installation and load calculations.

A number of local codes require an individual branch circuit for each cooking and oven unit over 1¾ kw. This came about largely because of a statement that appears on the Underwriters' Laboratories "Electrical Appliance and Utilization Equipment List."

This statement, which is under the UL listing of Domestic Ranges, reads: "These components (counter-insert surface-cooking unit assemblies, surface griddle units, and wall-insert ovens) are considered as individual units intended to be supplied from individual branch circuits." A recent discussion with an official of UL reveals that this statement will be deleted in view of recent changes that appear in the 1959 NEC.

New Code Rules

Because the words "counter-mounted cooking unit" and "wall-mounted oven" are mentioned in a number of sections in the 1959 NEC, appropriate definitions for these units now appear in Article 100.

Section 210-19 (c), Exception No. 1, has extended permission to reduce the size of the neutral conductor of 3-wire range branch circuits to 70% of the current-carrying capacity of the ungrounded conductors. However, this rule does not apply to smaller taps connected to a 50-amp circuit where the smaller taps (none less than 20-amp ratings) are of the same size. Further, it does not apply when individual branch circuits supply each wall- or counter-mounted cooking unit, and all circuit conductors are of the same size and less than No. 10.

Section 210-19 (c), Exception No. 2, and subparagraph (d) of Exception No. 2 permit tap conductors, rated not less than 20 amps, to be connected to 50-amp branch circuits that supply ranges, wall-mounted ovens and counter-mounted cooking units. These taps cannot be any longer than necessary for servicing. Figs. 1 and 2 illustrate the application of this rule.

Prior to the adoption of the 1959 NEC, the advanced report proposed that tap conductors to cooking appliances could extend to a maximum distance of 10 ft for installation and servicing. After discussion of this subject at the NFPA meeting last fall, it was decided that the wording be changed to read: "Tap conductors—shall be no longer than necessary for servicing." This was done to encourage the location of circuit junction boxes as close as possible to each cooking and oven unit connected to 50-amp circuits. At the same time it prevented the location of junction boxes in basements or attics where the lengths of taps would have to be stretched to 10 ft in almost every installation. Also, a number of counter-mounted cooking units have integral supply leads about 36 in. long, and some ovens come with supply conduit and wire in lengths of 48 to 54 in. Therefore, a box should be installed close enough to connect these leads.

Feeder and Circuit Calculations

Section 220-4 (i) refers to the feeder calculation of ranges and other cooking appliances. It permits the use of Table 220-5 for calculating the feeder load for ranges and other cooking appliances that are individually rated more than 1¾ kw. Also the footnote that follows Section 220-4 (i) recommends the use of Column A of Table 220-5 for the minimum feeder demand for ranges rated less than 8¾ kw, or where wall- or surface-mounted cooking units are to be installed. Table 220-5 (formerly Table 29) contains the following revisions: 1) The title of the table now includes wall-mounted ovens and counter-mounted cooking units; 2) Column 1 of the table has been changed to read: "Number of Appliances" instead of "Number of Ranges"; and 3) A new sentence has been added to Note 5 of the table and reads: "The branch circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance."

As a result of the present wording of Sections 210-19 (b) and 220-4 (i) and Table 220-5, a number of examples could be given which are entirely incorrect, electrically and logically. However, common sense implies that there is no difference in demand factor between a single range of 12 kw and, a wall-mounted oven and surface-mounted cooking unit totaling 12 kw. The mere division of a complete range into two or more units doesn't change the demand factor. Therefore, the most direct and accurate method of computing the branch circuit and feeder calculations for wall-mounted ovens and surface-mounted cooking units within each occupancy is to total the kw ratings of these appliances and treat this total kw rating as a single range of the same rating. For example, a particular dwelling has an 8-kw, 4-burner, surface-mounted cooking unit and a 4-kw wall-mounted oven. This is a total of 12 kw and the maximum permissible demand given in Column A of Table 220-5 for a single 12-kw range is 8 kw.

Similarly, it follows that if the ratings of a 2-burner counter-mounted cooking unit and a wall-mounted oven are each 3.5 kw, the total of the two would be 7 kw—the same total as a small 7-kw range. Because the 7-kw load is less than 8¾ kw, Column C of Table 220-5 may be used in lieu of Column A. The demand load is 5.6 kw (7 kw times 0.80). Range or total cooking and oven unit ratings less than 8¾ kw are more likely to be found in small apartment units of multi-family dwellings than in single-family dwellings.

Because the demand loads in Column A of Table 220-5 apply to ranges not exceeding 12 kw, it should also apply to wall-mounted

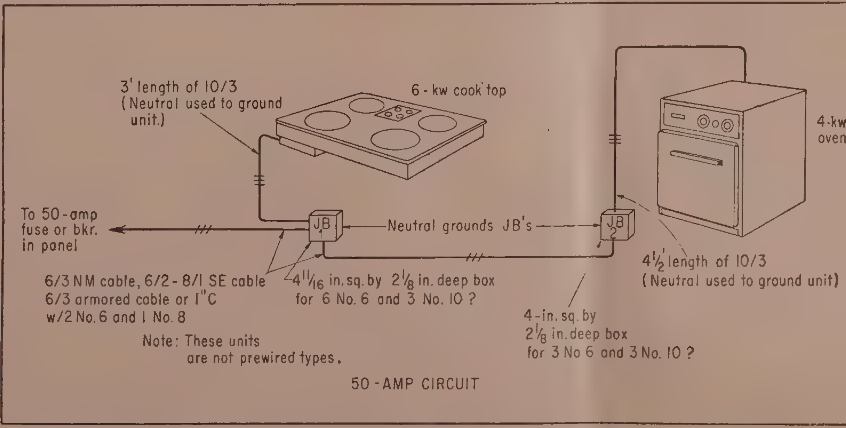

3' length of 10/3
(Neutral used to ground unit.)
6 - kw cook top
4-kw
oven
To 50-amp fuse or bkr. in panel
JB 1
Neutral grounds JB's
JB 2
6/3 NM cable, 6/2 - 8/1 SE cable
6/3 armored cable or 1" C
w/2 No. 6 and 1 No. 8
4¹¹⁄₁₆ in. sq. by 2⅛ in. deep box
for 6 No. 6 and 3 No. 10 ?
4½' length of 10/3
(Neutral used to ground unit)
4-in. sq. by
2⅛ in. deep box
for 3 No 6 and 3 No. 10 ?
Note: These units
are not prewired types.
50-AMP CIRCUIT

FIG. 2—New NEC rules permit a 50-amp circuit to supply cook tops and ovens. Typical arrangement shows such a circuit. Junction box sizes are computed by interpolation, as code tables do not specify box sizes for No. 6 conductors or combinations. Taps to each unit are No. 10 to permit the use of the neutral as an equipment ground. Grounding neutral to JBs requires special permission (Sections 250-61 and 250-57).

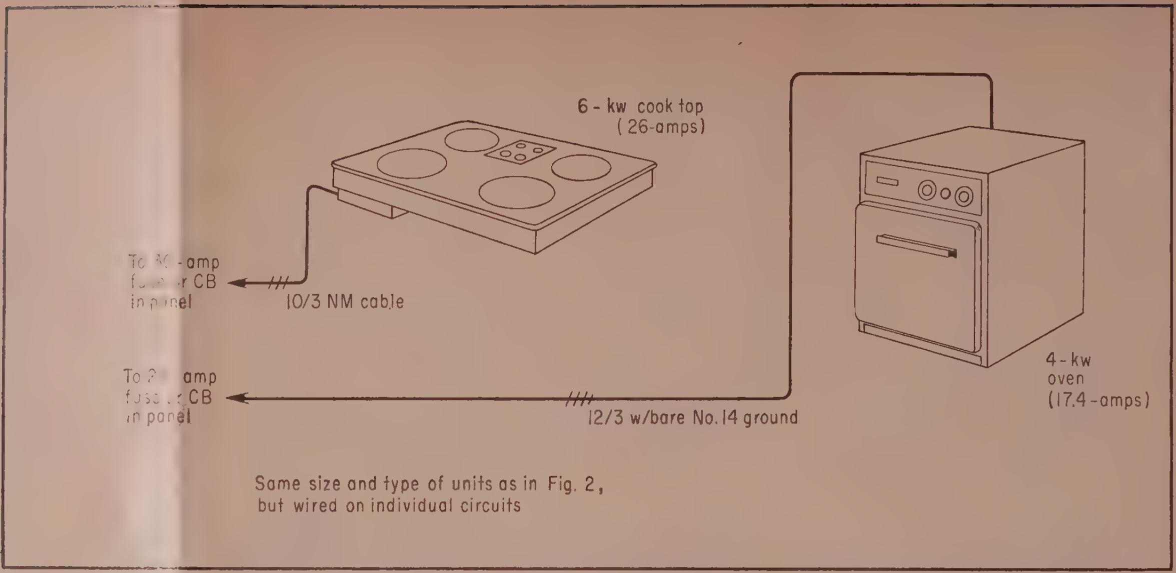


FIG. 3—Individual branch circuits supply the same units that appear in Fig. 2. With this arrangement, smaller branch circuits supply each unit with no JBs required. Although two additional fuse or CB poles are required in a panelboard, overall labor/material costs are less than the 50-amp circuit shown in Fig. 2. However, one disadvantage to individual circuits is that smaller size circuits will not handle larger units, which may be installed at a later date.

ovens and counter-mounted cooking units within each individual occupancy by totaling their aggregate nameplate kw ratings. Then if the total rating exceeds 12 kw, Note 1 to the Table should be used as if the units were a single range of equal rating. For example, assume that the total rating of a counter-mounted cooking unit and two wall-mounted ovens is 16 kw in a single-family dwelling. The maximum demand for a single 12-kw range is given as 8 kw in Column A. Note 1 requires that the maximum demand in Column A be increased 5% for each additional kw or major fraction thereof that exceeds 12 kw. In this case 16 kw exceeds 12 kw by 4 kw. Therefore, 5% times 4 equals 20%, and 20% of 8 kw is 1.6 kw. The maximum feeder and branch circuit demand is then 9.6 kw (8 kw plus 1.6 kw). In the case of individual dwelling units, a more direct method may be used by simply taking 0.4 kw for each kw or major fraction thereof that exceeds 12 kw, and adding the result to 8 kw. Again in this example, 16 kw exceeds 12 kw by 4 kw, and 4 times 0.4 kw gives 1.6 kw, or a total demand of 9.6 kw.

For the range or cooking unit demand factors in multi-family dwelling, a 12-unit apartment building is used as an example. Each apartment has a 6-kw counter-mounted cooking unit and a 4-kw wall-mounted oven. And each apartment is served by a separate feeder from a main switchboard. The maximum cooking demand in each apartment feeder should be computed in the same manner as previously described for single-family dwellings. As the total rating of cooking and oven units in each apartment is 10 kw (6 kw plus 4 kw), Column A of Table 220-5 for one appliance should apply. Thus, the maximum cooking demand load on each feeder is 8 kw.

In figuring the size of the main service, Column A should be used for 12 appliances. Thus, the demand would be 27 kw. Again the total rating of cooking and oven units (10 kw) in each occupancy is the same as a single (10 kw) range.

As a substitute, assume that each of the 12 apartments has a 4-kw counter-mounted cooking unit and 4-kw wall-mounted oven. This would total 8 kw per apartment. In this case Column C of Table 220-5 can be used to determine the cooking load in each separate feeder. Applying Column C on the basis of a single 8-kw range, the maximum demand is 6.4 kw (8 kw times 0.80). Therefore, 6.4 kw is the cooking load to be included in the calculation of each feeder. Notice that this is 1.6 kw less than the previous example where cooking and oven units, totaling 10 kw, had a demand load of 8 kw. And this is logical, because smaller units should produce a smaller total kw demand.

On the other hand, consider using Column A instead of Column C for computing the main service capacity for 12 8-kw cooking loads. The reason for this is that Column C is inaccurate where more than five 8-kw ranges (or combinations) and more than 12 7-kw ranges (or combinations) are to be used. In these instances, calculations made on the basis of Column C result in a demand load greater than that of Column A for the same number of ranges. As an example, 12 8-kw ranges have a demand load of 30.72 kw (12 times 8 kw times 0.32) in applying Column C, but only a demand load of 27 kw in Column A. And in Column A the 27 kw is based on 12 12-kw ranges. This discrepancy has existed since the range table was formulated in 1947. Until Table 220-5 is corrected, it is best to use Column C only on the limited basis previously outlined.

Branch Circuit Wiring

Where individual branch circuits supply each counter-mounted cooking unit and wall-mounted oven, there appears to be no particular problem. Figs. 1 and 3 give the details for wiring units on individual branch circuits.

Fig. 2 shows an example of how typical counter-mounted cooking units and wall-mounted ovens are connected to a 50-amp branch cir-

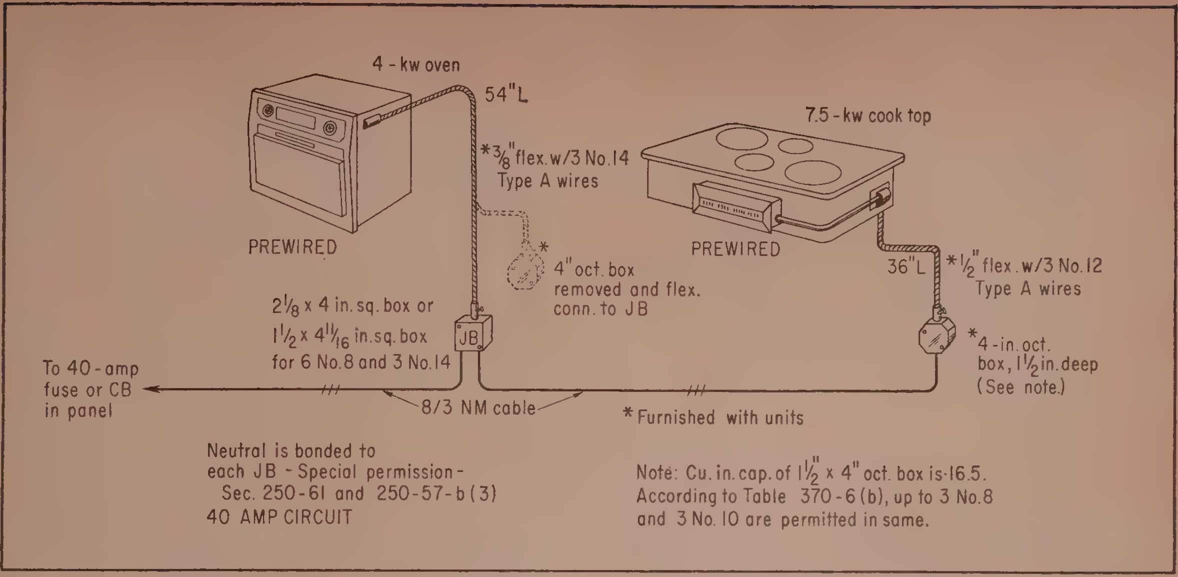

4 - kw oven
54"L
PREWIRED
*3/8" flex. w/3 No. 14 Type A wires
7.5 - kw cook top
PREWIRED
36"L
*1/2" flex. w/3 No. 12 Type A wires
4" oct. box removed and flex. conn. to JB
2 1/8 x 4 in. sq. box or 1 1/2 x 4 11/16 in. sq. box for 6 No. 8 and 3 No. 14
JB
*4-in. oct. box, 1 1/2 in. deep (See note.)
To 40-amp fuse or CB in panel
8/3 NM cable
* Furnished with units
Neutral is bonded to each JB - Special permission - Sec. 250-61 and 250-57-b(3)
40 AMP CIRCUIT
Note: Cu. in. cap. of 1 1/2" x 4" oct. box is 16.5. According to Table 370-6(b), up to 3 No. 8 and 3 No. 10 are permitted in same.

FIG. 4—Many inspection authorities permit 40-amp circuits in lieu of 50-amp circuits where the aggregate nameplate rating of cook tops and ovens is less than 15.5 kw. Reasoning behind this is that there is no difference between these appliances and a single range that equals their combined rating. Most ranges are less than 15.5 kw and so are most combinations of cook tops and ovens. Units shown here are the prewired types.

cuit. This arrangement has one distinct advantage in that junction boxes, containing No. 6 conductors, are located close to each appliance. Then, if larger cooking appliances should be installed at a later date, the changes can be made at a minimum cost. However, the inital cost of a 50-amp circuit in the average installation will be higher than individual branch circuits of smaller capacities that supply each appliance. How much more will depend largely on the type of cooking and oven units involved.

Several manufacturers of cooking units provide an attached flexible metal conduit with supply leads and a floating 4-in. octagon box as a part of each unit. These units are commonly called "prewired types." With this arrangement, an electrician does not have to make any supply connections in the appliance. Where such units are connected to a 50-amp circuit, the 4-in. octagon box is removed, and the flexible conduit is connected to a larger circuit junction box, which contains the No. 6 circuit conductors.

On the other hand, some manufacturers do not furnish supply leads with their cooking units. As a result, the electrical contractor must supply the tap conductors to these units from the 50-amp circuit junction box. See Fig. 2. In this case, connections must be made in the appliance as well as in the junction box. Therefore, additional labor and material costs for the installation of these units on the same circuit are inevitable as compared to cooking units that have integral supply conduit and wire.

In Fig. 2, a $2\frac{1}{8}$ by $4\frac{11}{16}$ in. sq junction box is used for six No. 6 and 3 No. 10. This was computed by interpolation, since Table 370-6(a-1) does not include No. 6 conductors. But if ten No. 8 conductors can be installed in a $2\frac{1}{8}$ by $4\frac{11}{16}$ in. sq box, it is reasonable to assume that up to six No. 6's and three No. 8's can also be installed in the same size box. Also, this is the largest trade size box available. Larger sizes would have to be pull boxes, which are far more costly.

40-Amp Circuits

While the NEC does not recognize a 40-amp circuit for two or more outlets, a number of inspection departments permit such circuits to supply counter-mounted cooking units and wall-mounted ovens. If a No. 8 (40-amp) circuit can supply a single range less than 15.5 kw, it is logical that it can also supply counter and wall-mounted units not exceeding the same total of 15.5 kw.

Fig. 4 shows an arrangement of a No. 8 (40-amp) branch circuit supplying one 7.5-kw cooking unit and one 4-kw oven. Fig. 5 shows individual branch circuits run to the same size units as listed in Fig. 4. If 40-amp circuits as shown in Fig. 4 are permitted, here is an example where grouping cooking and oven units on the same circuit can compete in cost with individual circuits.

In both Figs. 4 and 5, 8/3 NM is run to the 7.5-kw cook top. From here it is a matter of choice whether to extend the No. 8 circuit to the oven unit, or run a separate branch circuit (which will require two additional poles in the panelboard). In many instances a 40-amp branch circuit, as shown in Fig. 4, may cost less than individual branch circuits, depending on panelboard requirements, length of homeruns, and location and size of cooking and oven units. And in all cases, a 40-amp circuit will cost less than a 50-amp circuit.

Another justification for the 40-amp circuit is in remodel jobs. Many homes already have a No. 8 range circuit. And where a kitchen is remodeled, a new built-in cooking unit and oven often replace an old electric range. If the existing No. 8 circuit can be used, new cooking units and ovens can be installed without the necessity of new branch circuits in most instances.

If No. 8 circuits are used, the size of junction boxes present no problem because Tables 370-6 (a-1) and 370-6 (b) cover any combination of conductors, No. 8 and smaller. However, these tables do not give the interior cu in. capacity

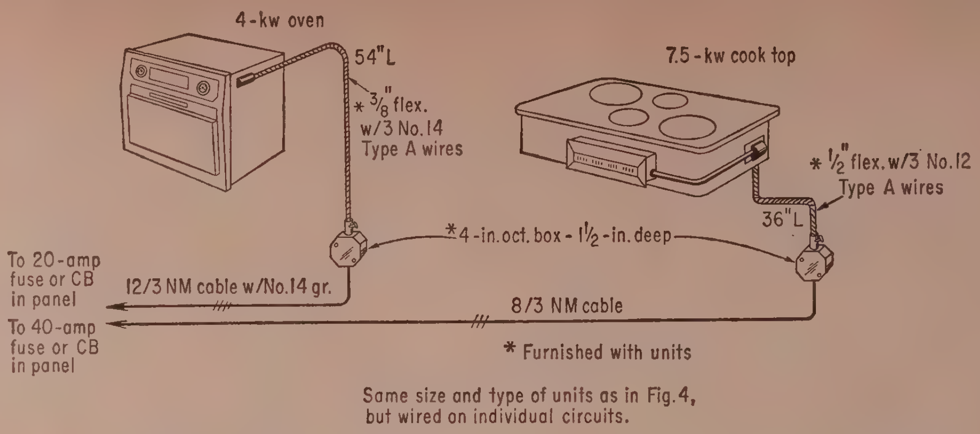

4-kw oven
54"L
* 3/8" flex. w/3 No.14 Type A wires
7.5-kw cook top
* 1/2" flex. w/3 No.12 Type A wires
36"L
*4-in. oct. box - 1½-in. deep
To 20-amp fuse or CB in panel
12/3 NM cable w/No.14 gr.
To 40-amp fuse or CB in panel
8/3 NM cable
* Furnished with units
Same size and type of units as in Fig. 4, but wired on individual circuits.

FIG. 5—Same size units that are shown in Fig. 4 are wired on individual branch circuits for purposes of comparison. Notice that two additional fuse or CB poles are required in a panelboard as the result of an additional 230-volt circuit. Additional run of 12/3 cable is also required, and here a single 40-amp circuit could be a very economical choice.

of outlet boxes to assist in computing the required box size where different sizes of conductor combinations are encountered. For this reason the table below lists the trade size boxes and their cu in. capacity for use with No. 8 circuit wiring. The cu in. volumes given are averages of several manufacturers.

SE Cable

Section 338-3 (b) now permits the use of SE cable for circuits supplying wall-mounted ovens and counter-mounted cooking units. However, if present price differences between SE cable and NM cable are maintained, SE cable will probably be used only where part of a circuit run is outdoors, or where 75C supply conductors must be used to connect appliances. Latest industry prices reveal that SE cables, in sizes 8/3 and smaller, cost more than corresponding sizes of NM cables. And even though 6/2, 8/1 SE cable costs slightly less than 6/3 NM cable, additional labor costs more than offset the total installation cost in favor of the 6/3 NM cable.

Section 338-3 (c) is a new provision and states: "Service-entrance cable used to supply appliances shall not be subject to conductor temperatures in excess of the temperature specified for the type of insulation involved."

The insulated conductors of SE cables are either 60 C or 75 C, and if they are rated at 75 C, such marking will appear on the outer sheath. A cooking unit or oven that requires 75 C supply conductors would be an application for the use of SE cables, rated at 75 C. However, a review of UL listings for cooking units and ovens indicates that the vast majority of such units do not require supply conductor ratings to exceed 60 C. Fig. 6 shows a method of connecting cooking units where the supply conductors are required to be 75 or 90 C.

Grounding

Section 250-60 permits the use of a grounded circuit conductor of not less than No. 10 to serve as the equipment ground for counter-mounted cooking units and wall-mounted ovens, provided that the grounded conductor is part of a 120/240-volt, 3-wire branch circuit. While a 120/240-volt, 3-wire branch circuit is specifically stated, Mr. Inskip, Chairman of Panel No. 5, says that the grounded conductor could be part of a 3-wire, 208/120-volt branch circuit, which is taken from a 208Y/120 volt supply. Where major cooking appliances are provided in large apartment buildings, it is a common practice to use a 4-wire 208Y/120-volt service and run 3-wire 208/120-volt feeders to each apartment. And although the grounded conductor of a 3-wire 208/120-volt circuit will normally carry more line current than the grounded conductor of a single-phase, 3-wire, 120/240-volt circuit, this has nothing to do with whether or not the grounded circuit conductor can serve as an equipment ground. In any event, it would be very helpful if the code could clarify this point.

While it is clear that a grounded circuit conductor (No. 10 or larger) can be used to ground the frames of cooking or oven units,

TRADE SIZE BOX	*CU IN. CAPACITY	MAXIMUM NO. OF WIRES No. 12	No. 10	No. 8
1½ x 4-in. octagonal	16.5	7	6	5
2⅛ x 4-in. octagonal	23.0	10	8	6
1¼ x 4-in. sq	18.0	7	6	4
1½ x 4-in. sq	21.1	9	7	5
2⅛ x 4-in. sq	29.9	12	10	8
1½ x 4$\frac{11}{16}$-in. sq	30.0	12	10	8
2⅛ x 4$\frac{11}{16}$-in. sq	42.0	16	12	10

* For determining combinations not shown in Table.

CONDUCTOR SIZE	*FREE SPACE WITHIN BOX FOR EACH CONDUCTOR
No. 12	2.25 cu in.
No. 10	2.5 cu in.
No. 8	3.0 cu in.

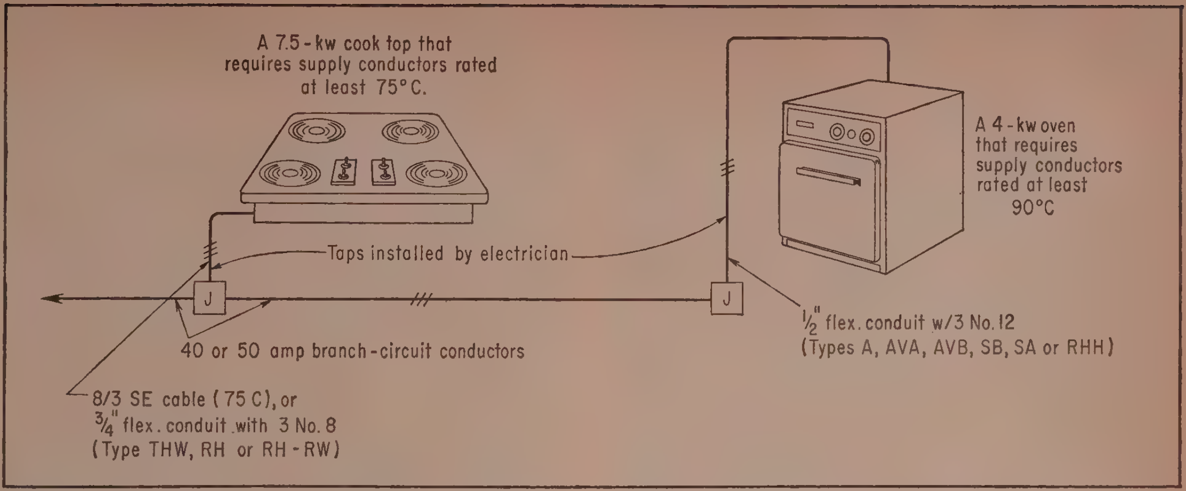

A 7.5-kw cook top that requires supply conductors rated at least 75°C.
A 4-kw oven that requires supply conductors rated at least 90°C
Taps installed by electrician
J
J
40 or 50 amp branch-circuit conductors
1/2" flex. conduit w/3 No. 12 (Types A, AVA, AVB, SB, SA or RHH)
8/3 SE cable (75 C), or 3/4" flex. conduit with 3 No. 8 (Type THW, RH or RH-RW)

FIG. 6—Some cook tops and ovens require the use of supply conductors that have insulation ratings exceeding 60C. In these instances tap conductors of the proper insulation values must be installed by the electrical contractor. Sketch shows a typical application. Vast majority of UL listed cook tops and ovens permit 60C supply conductors.

several other grounding problems are now apparent because of the recognition of 50-amp cooking appliance circuits. Where taps smaller than No. 10 are taken from a 50-amp circuit to a cooking or oven unit, a grounded circuit conductor cannot serve as an equipment ground. Hence, other means for grounding the cooking or oven units must be provided. If a separate grounding conductor is used to ground cooking or oven units that are connected to a 50-amp circuit, Table 250-95 requires a minimum size of No. 10. On the other hand, if the connection to a cooking or oven unit is made by a grounded armored cable or flexible metal conduit, Section 250-57 (a) approves this method of grounding. Paradoxically, the metallic armor of a 12/3 armored cable and a $\frac{3}{8}$-in. flexible conduit has a resistance of about 0.64 ohm per 100 ft, which is about the equivalent of a No. 18 copper wire (0.65 ohm per 100 ft). An untinned, bare No. 14 copper has less resistance than the armor of a 6/3 armored cable. Therefore, it doesn't seem unreasonable that where a 12/3 NM cable containing a bare No. 14 grounding conductor is used as a tap of a 4-kw oven from a 50-amp circuit, that the No. 14 grounding conductor could serve as the grounding conductor for the oven frame. And with such taps the lengths would rarely exceed 5 ft. As a result, a 5-ft length of No. 14 will have a very low resistance of 0.013 ohm. While the code recognizes smaller branch circuit taps, there is no apparent provision that permits a reduction in size of a grounding conductor.

In the case of 40- or 50-amp circuits, common practice has been to ground each junction box to the neutral conductor of the branch circuit. This in turn will ground the flexible conduit supply connections (furnished with prewired units) when it is connected to the junction box. Yet, according to Sections 250-61 and 250-57-b (3), this requires special permission.

Disconnecting Means

While there has been considerable debate on what constitutes a disconnecting means for wall-mounted ovens and counter-mounted cooking units, code rules are definite. Sections 422-17 and 422-17 (c) permit the service disconnecting means in a single family dwelling to serve as the disconnecting means for appliances that contain unit switches. All cooking and oven units have one or more unit switches.

New Section 422-13 recognizes a separable connector or a plug and receptacle combination in the supply line to an oven or cooking unit. However, such plug-in devices cannot be classed as a disconnecting means. In view of the provisions of Section 210-21, 50-amp receptacles would have to be provided if plug-in leads are used with oven or cooking units that are connected to 50-amp circuits. Generally, such an installation would be quite costly, especially since manufacturers do not equip their units with a cord and plug cap. As a result, it is unlikely that very many installations of this nature will be made. However, past controversies of intent have been clarified by this new provision, and the way is clear for those who desire to use such plug-in connections.

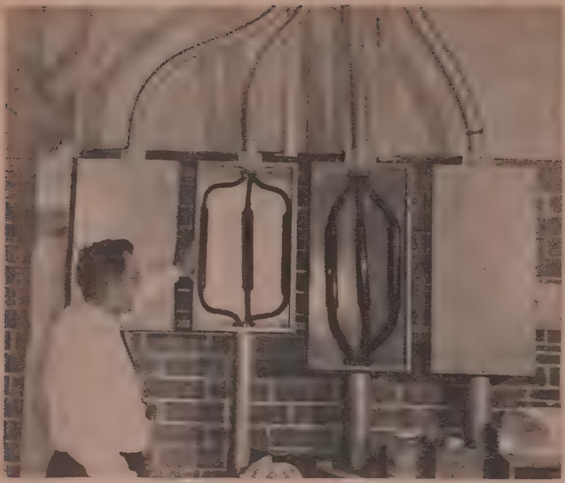
While economic considerations will preclude such use for electrical built-in cooking units, it practically legalizes 115-volt plug-in connections for built-in gas ovens.

Most gas wall-mounted ovens come equipped with a two-wire, heat resistant cord for connection to a 115-volt receptacle, which is installed in the recessed wall or cabinet space for the oven.

If a ground fault occurs, the current must follow a grounding path through the gas piping system to the water piping system, and back to the grounded neutral in the service panel to open the branch circuit overcurrent device. This could result in a high impedance grounding path, or in some cases, there may be no ground at all.

Where gas supplies only cooking equipment in a residence, the gas piping is often ungrounded because of an insulating coupling which is placed at the point of entrance into the building. This is one of the reasons some local codes require permanent circuit and grounding connections to gas cooking units which contain electrical devices.

Others may have additional suggestions to improve code rules for cooking appliances. Any such suggestions should be directed to the proper NE code-making panel.



PLASTIC MOLD in-line splices with epoxy resin provide neat and simple transition from single-conductor to 3-conductor cables in the 4,160-volt circuits. Splicing time was less than half that required for conventional methods.

T-TAPS in this overhead junction box were made with the resin pressure method. Total time for three 600 MCM, 4,160-volt taps was nine man-hours including instruction to mechanics unfamiliar with materials and techniques.

A Field Report on

Cutting High-Voltage Splicing Time

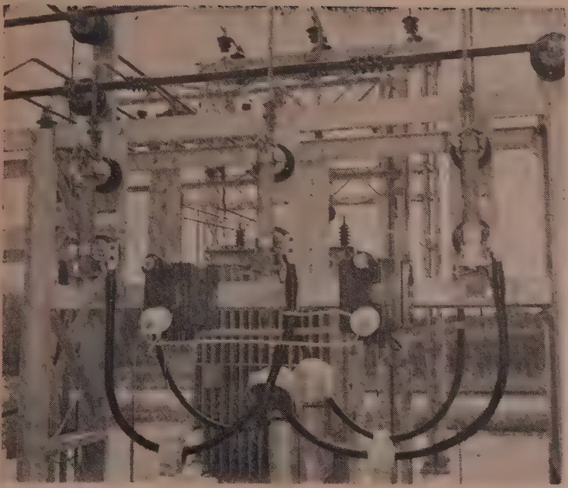
An Atlanta contractor finds epoxy resin kits slashed man-hours required to make 4,160-volt splices and terminations on an industrial project.

BE AWARE of and take full advantage of new developments and improvements in materials and installation techniques. This is a basic maxim in the business philosophy of the Cleveland Electric Company, Atlanta, Ga., contracting firm. By doing this, they frequently are able to cut installation time substantially and do a better job for the customer on a mutually economical basis.

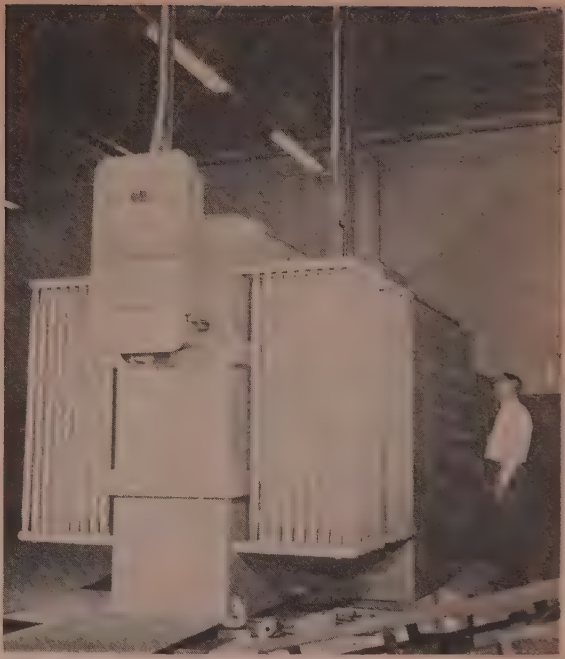
The high-voltage splices on the 4,160-volt distribution system at the new American Art Metals Company extrusion and fabricating plant in Atlanta provide a good example of this successful approach. Epoxy resin pressure-type splicing kits were ordered for the 24 splices and terminations involved. By using the plastic mold pour and pressure injection techniques, C-E mechanics were able to trim 50% or more off the man-hours normally required to make the conventional built-up tape splices. And this includes the initial "training" time required to acquaint inexperienced mechanics with the improved techniques. In addition, the natural adhesive qualities of the epoxy resins and their compatability with all common wire and cable insulations provided a tough, moisture-proof, electrically sound, well insulated connection at these critical splice and termination points.

Contractor's field reports indicated the following time economies on the specific splices involved.

Nine man-hours were required to



OUTDOOR TERMINATIONS of 4,160-volt, Type RR conductors to power company transformer structure were made with resin pressure method in about half normal time. Quality of connections was also improved.



OIL SWITCH termination of 3-phase, 4,160-volt feeder at end of 2,000-kva extrusion press substation. Resin pressure termination of three conductors took three hours instead of reported 12 hours for conventional method.

make three T-splices on a 600 MCM, Type RR, 4,160-volt, direct service line brought in to feed two induction units which heat aluminum prior to extrusion. The tap was to a 3-conductor, 600 MCM, Type RHW, aluminum interlocked armor cable for one of the units, each of which serves a 2,300-ton extrusion press. The induction units heat aluminum billets, each 8 in. in diameter and 27 in. long, from room temperature to 800° F in less than 90 seconds. The nine hours includes five man-hours, with foreman's time, spent on the first splice with two inexperienced electricians receiving instruction from the manufacturer's representative. The remaining two taps were completed by the on-the-job "trainees" in two man-hours each.

Savings in labor costs on these three T-splices alone were more than $50 or almost two days' labor for one man. All splices were made by regular electricians who had not been introduced to resin splicing before reporting to this job.

A 75% saving in labor costs was effected on three 4,160-volt, compression-lug terminations in a 3-phase, oil-filled disconnect and grounding switch in the 2,000-kva unit substation serving the extrusion presses. The three resin pressure terminations were completed in three hours—or an average of one hour per termination. Normal estimated time for conventional methods is reportedly four hours per terminal, or a total of 12 hours for the three conductors.

Less than half the normal man-hours were required by the splicing crew to make 12 in-line splices using resin splicing kits with plastic molds to contain the poured resin. These splices were made at service entrances where transition from single-conductor, Type RR cables to 3-conductor, Type RHW, aluminum cables occurred.

Outdoor Splices

Similar time economies were reported on six outdoor terminations. Here, the resin pressure technique was used on the 300-amp, 4,160-volt Type RR cable connections to the power company's transformer station.

Power for the new plant is provided by an 8,000-kva service with five 4,160-volt feeders. Two 600 MCM, 3-phase, circuits serve the two induction heaters and a 2,000-kva substation for the extrusion presses. Three 250 MCM circuits serve a 1,500-kva substation for the anodizing area where the 480-volt secondary current is rectified to 24-volt direct current; a 1,000-kva substation for 460 hp of buffing equipment operating on 480 volts; and a 500-kva unit substation for the final assembly and office areas. All unit subs provide 277 volts for lighting throughout the plant.

The high-voltage splicing represents only a small, though vitally important, part of the overall electrical work on this subject. But the contractor's willingness to use new materials and methods resulted in substantial time economies even with mechanics previously untrained in the new techniques. It's indicative of Cleveland Electric's far-sighted approach to cost reduction in all phases of electrical construction and shows that competitive tools far more safe and potent than the "sharp pencil" are available to alert management.

Facts Focus on the Future of . . .

Electric Heating In Apartments

Electric heating in apartments is a smash hit in Seattle, Washington. So much so that over 75% of all apartment units built in this area since 1954 have electric heat. A utility expert reveals why this trend can't miss spreading to other parts of the country.

By R. C. Cornelius, *Rate Engineer, Seattle City Light*

ABOUT 1953, several top architects, consultants and builders in Seattle carefully analyzed the possibility of heating new apartment buildings electrically. As a result of their studies, several apartments were constructed using electric heat.

After studying the performance of the electric heat in these buildings for a complete heating season, this method of heating apartments caught on so rapidly that it practically inundated other methods of heating.

To fully appreciate the rapid growth of apartment electric heating in Seattle, I have quoted figures below that we developed earlier in preparing a forecast of the growth of electric heat.

Figures up to March 1, 1960, indicate that the total electrically heated apartment units are 8,798, an increase of 2,776 since the end of 1958. As a result, over 75% of the new apartment house construction since 1954 has gone to electric heating.

A new 112-unit co-op apartment building in Seattle is the largest of the electrically heated apartments to date. Most of the units in this building have one bedroom each, several have two bedrooms, and four or five have three bedrooms.

The majority of electrically heated apartments in the Seattle area are one bedroom, kitchenette, bath and living room with an average area of 500 sq ft. Each apartment has an electric range (10 kw) and a 40-gallon electric waterheater (3 kw) which along with lighting and the electric heat, is metered and billed to each tenant.

Total annual electric use for the average apartment dweller, including heat, is generally less than the average single-family home with electric cooking and water heating, but not using electric heat. Electrically heated apartment units average between 8,000 and 9,000 kwh per year at a prevailing rate of slightly over 1 cent per kwh. As a result, $80 to $95 for heating, lighting, cooking, and water heating represent the average annual cost per unit apartment.

Our Seattle - Tacoma Airport weather station's annual average of 5,275 degree days is used as a reference for our heating energy calculations. In other areas which have higher DDs or rate structures, additional insulation will be required to provide comparable costs for electrically heated apartments.

In talking with various business people connected with the construction and operation of electrically heated apartment buildings, I find lending institutions apparently loan money as readily for construction of electrically heated apartment houses as for apartments using other means of heat. However, they do watch the type of construction to make sure it is of good quality and has adequate insulation. The appraiser at one savings and loan association stated that they must look ahead to the time when they may have to foreclose on a mortgage. And they feel that the practically self-operating, electrically heated apartment would be of an advantage to them over apartments with central heating systems requiring custodial operation. Another savings and loan association appraiser also stated that money is readily available for financing, but that they do insist on sufficient insulation and generally restrict loans to apartment buildings with small living units usually not in excess of 700 sq ft in area. And he added

Year	Apartment Living Units Constructed	Electrically Heated	Percentage
1954	555	444	80
1955	1,426	1,152	81
1956	1,288	759	58
1957	2,405	1,702	71
1958	2,259	1,965	87
TOTAL 5 YEARS	7,933	6,022	76

that electrically heated apartment buildings have a good resale value. The fact that they are self-operating adds to the value.

The FHA in the Seattle area is not presently financing construction of electrically heated apartments above a four plex. In the past when they did approve loans on larger buildings, they did not approve loans on balcony-type apartments, as these buildings did not meet the FHA standards. For electrically heated apartments of four plexes or less, the FHA will approve financing as readily as they will for apartment houses with other methods of heating.

Cost Savings

Many architects and builders in the Seattle area point out that (1) the installation cost of electric heating in a 100-unit apartment building can be as much as 60% lower than the cost of other heating systems; (2) electric heat requires only existing wall space, and it also saves the space in the basement generally required for central heating plants; and (3) maintenance is much less with electric heating, and also there are no custodial or operating costs for heating.

From the apartment owners' and operators' points of view electric heat is quite desirable, because tenants regulate and pay for their heating requirements. And tenants' complaints about temperature with central heating systems are eliminated. Actual heating energy use is less when the tenant regulates the temperature, and heat is not unnecessarily wasted. And as there are no building fuel bills or custodial costs, the rent revenue reflects a greater portion of net income.

Real estate brokers report no sales resistance to electrically heated apartments, and in fact, many investors in the Seattle area prefer apartments that are self-operating. After talking with many persons interested in various phases of apartment building construction and operation, I believe that the comments of one man sums it up for all the people contacted.

He is a prominent Seattle architect who has designed many electrically heated apartments and who is also actively associated with a group that owns and operates several of these electrically-heated buildings. He made this statement about the use of electric heat in apartment buildings. He said: "The operating organization of which I am a part operates 350 apartment living units in buildings ranging from four units per building up to 50 units. The first was constructed in 1954 and was one of the first of its type financed through FHA.

"Our operating group has restricted our construction of new apartments to those with living units having a nominal 400 or 500 sq ft each. This is a result more or less of the utility rate rather than a construction or heat loss problem. Many utility rates develop slightly higher average rates as higher-than-normal residential demands are encountered."

He also stated that during the several years of management and operation of their electrically heated apartments, they experienced little or no maintenance cost on the heating equipment. Nor was any custodial care required to look after the heating plants.

Also his records of new construction costs indicate that the cost of good electric heating equipment is the same or less today than the cost of the same equipment four or five years ago. This he attributes to the fact that manufacturers have greater volume of sales and market today, more manufacturing experience, and more competition.

This operating group has not experienced any resistance in financing electrically heated apartments, and he reported that there is adequate private capital available for this type of construction in the Seattle area. His final statements in my interview with him were, "When good judgment has been used in planning the electric heating installation in a well constructed apartment building, we have had no problems with electric heat. Less actual heating energy is used in these buildings because the customer pays for it and uses only what he requires. The cost of installing electric heat and the overall operating cost is the least expensive method of heating apartment units up to 500 sq ft in size. With automatic operation of the heating system under the control of the tenant, along with automatic electric water heating equipment, the building is self-operating."

As a utility we do not generally get into the cost of the heating equipment itself or the actual costs of installations. However, I made some inquiries recently and obtained the following information concerning accepted bids on three apartment electric heat jobs.

These bids include not only the electric heat equipment installation, but also the entire electrical wiring for all electrical uses in the building for lighting, electric ranges, and 40-gal electric water heaters in each apartment, plus a water heater and dryer in the laundry service room. The bids do not include the cost of lighting fixtures, ranges, water heaters, or dryers.

These bids were:

8-unit building (1 bedroom units)	$3,600
Approximately 5 kw heat per unit	($450/unit)
12-unit building 6-1 bedroom units	$8,200
6-2 bedroom units	($680/unit)
48-unit building, predominantly 1 bedroom	$42,000
some 2 bedrooms	($875/unit)

From a utility point of view, I would like to mention one or two situations that are likely to need attention as the application of electric heating in apartment buildings spreads to other areas.

Proper Design

A primary consideration is the need for sound engineering of the electric heating installations. While utilities can and do provide an advisory service in this respect, it is believed that the best interest of the apartment builder, owner, operator, and tenants (as well as the utility) will be assured if the electric heating system is designed or approved by professional people either at the architect's office or that of the consulting engineer. By past experience we have found that there are conditions in the stress of speculative building or in competitive bidding that can lead to an inadequate or undersized heat installation: If this does happen, and more heating capacity is added to existing circuits, the circuits as well as the main line switch and service may be undersized as a result. This can lead to serious and costly consequences, not to speak of the dissatisfaction of all people involved.

One other situation that developed during the earlier heat installations was the general practice of apartment managers in advising prospective tenants that they could expect their electric bills including

(*Continued on page* 249)

PLEXIGLASS CEILING formed from matte-finished square-corrugated panels is installed above teller and office sections in modern bank, while louvered downlights are recessed in dropped central canopy to illuminate check-writing desks, traffic areas, stairs, entrance thresholds and special display areas.

Electrical Features Of New Seattle Office Building

New structure offers high-level lighting, multi-level duct systems and combination of heating-cooling and lighting-ventilation. Electrically designed by Gilbert H. Mandeville, PE, the installation was handled by Anderson Electric of Bellevue.

SEATTLE'S new Logan Building offers an open-threshold "air door" defining an entrance to a modern bank; an uplighted "water wall" flanking an open stairway; a recessed office-area lighting installation employing the new 3500-lumen 40-watt lamp; underfloor distribution utilizing 2-level communication duct arrangements; 24-volt relays controlling 277-volt lighting; electric coil-and-fan units combining heating and cooling requirements, plus combinations of slab-contained "miracle cans" and bottom-extension outlet boxes providing unlimited flexibility for receptacle and telephone placement.

Several of these highlights are unique, generally, and are "firsts" for the west coast. For example, the "air door" presents no visual or physical barrier between the interior of the building and the sidewalk, yet cold (or hot) air, dust, dirt and rain are effectively excluded by a blanket of slowly-moving air that continuously flows from top to bottom of the entranceway. V-shaped "sensing" vanes, located above, automatically swivel to direct this air curtain against the flow of air sweeping in from the street; the angle of vanes becoming more acute as gusts develop which would normally blow through an unobstructed entry.

This air curtain is propelled by a wide-bladed squirrel-cage blower located above a grille contained in the entrance canopy; air so used (as well as drippings from customers' rain-wet feet and clothing) passes downward through a corresponding threshold grille; water and debris so accumulated is periodically flushed to a sump, and air is recirculated to the overhead blower via a bank of dirt-screening filters.

Temperature is likewise controlled by pre-heat coils so that, should a person stand directly in the center of the air door, there would be no noticeable detection of heat or cold moving into or out of the building. Relative temperatures are governed by seasons.

Combining light-for-safety with light-for-ornamentation, a series of

INVERTED-T FRAMEWORK supports lighting fixtures and same-width louvered-metal sections serving as plenum vents. Shallow-depth luminaires provide low-brightness illumination through Cleartex diffusing panels. Fixture variations include 2- and 3-lamp assemblies in either 2- by 4-ft or 2- by 2-ft fixtures.

REMOTE CONTROL of 277-volt luminaires is via 24-volt relays installed in wiring channels of key fixtures in each circuit; low-voltage thermoplastic-covered wiring connecting with two switching positions in each bay. Voltage at 277 for lamp operation is obtained via flexible leads.

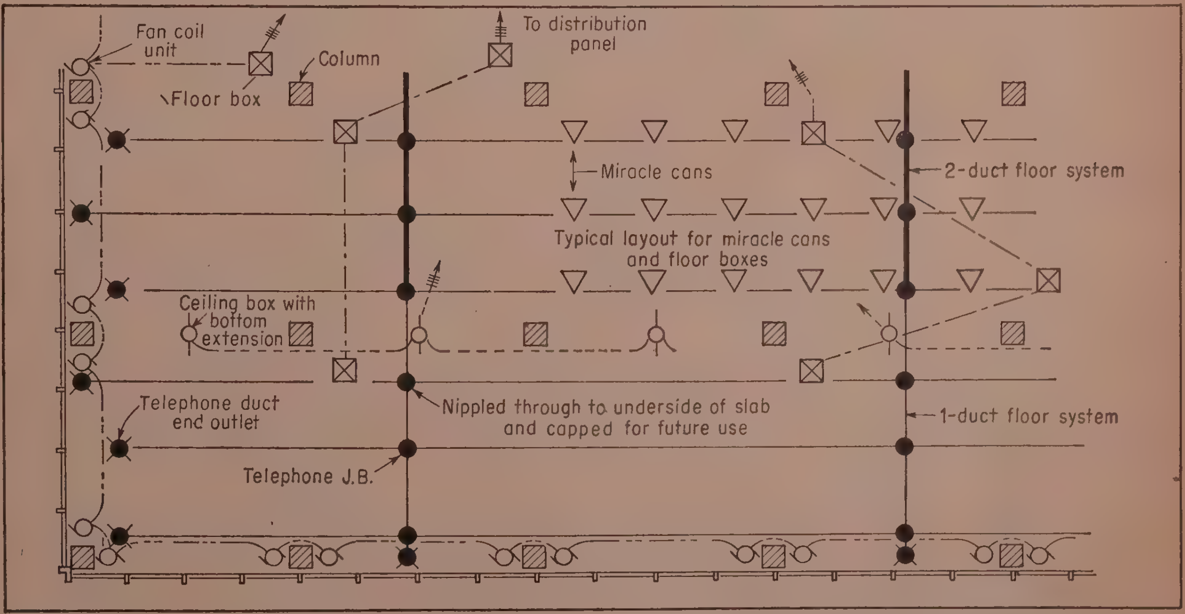
3500-LUMEN LAMPS are installed in 2- by 4-ft plastic-diffused fixtures arranged side-by-side, end-to-end or as individual units to provide variety of lighting arrangements and intensities to suit tenant requirements. Minimum lighting standard in building is 50-fc although this level is consistently exceeded.

150-watt adjustable louvered downlights is recessed in the air-door canopy to illuminate the threshold, while high-intensity "wall washing" asymmetric-reflector luminaires are mounted above narrow ceiling slots to evenly light a marble wall containing a night depository, and aluminum panels which are slid into place at night to close the entrance way.

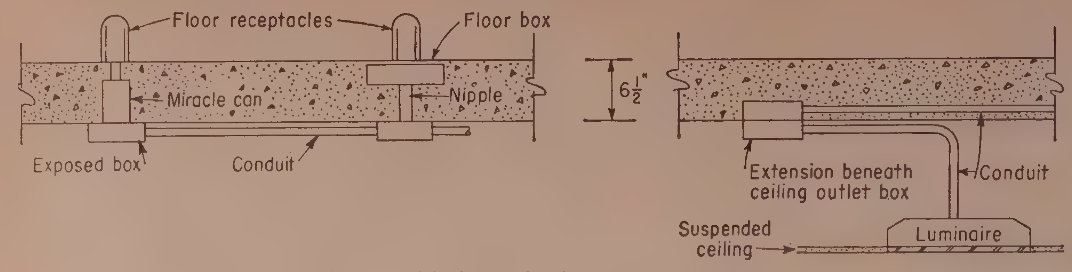
The second-mentioned "water wall" is bottom-lighted; a broad curtain of water flowing down over a mosaic-tiled wall to splash into a wide pool where floodlights, positioned just beneath the surface of the water, direct vari-colored lighting patterns upwards. Due to continuous water movement, these patterns of color constitute pleasingly animated displays.

General illumination in the building's main lobby is provided by a wall-to-wall louvered ceiling; the light source being fluorescent and the louvers being anodized with a bronze finish to blend with general hardware in the lobby and with dramatically-toplighted, statuary.

Within the first-floor bank, lighting above office areas and teller cages is provided by a luminous ceiling consisting of matte-finish acrylic plexiglass with square 1-in.-wide corrugations; this suspended ceiling being backlighted by rapid-start cool-white lamps operating at 430-ma and supported by single-lamp strips installed in continuous rows on 3-ft centers positioned 30 in. above the plastic panels. The


Fan coil unit
Column
Floor box
To distribution panel
Miracle cans
2-duct floor system
Typical layout for miracle cans and floor boxes
Ceiling box with bottom extension
Telephone duct end outlet
Nippled through to underside of slab and capped for future use
1-duct floor system
Telephone J.B.

TYPICAL FLOOR is equipped with 1- and 2-level underfloor telephone duct system, 120-volt power receptacles served variously through floor boxes and related miracle cans, slab-contained conduit branches carrying 277-volt current to bottom-extended ceiling outlets, 24-volt relay switching for lighting, and fan-coil units for heating-cooling combination.



Details of floor and ceiling outlets in slabs of typical office floors.

MIRACLE CANS set flush with bottom of 6½-in. slab are reached from above by drilling through intervening concrete skin, while floor-flush boxes are nippled down to connect with under-slab exposed boxes and conduit connections. Ceiling outlet boxes related to lighting circuitry are equipped with extensions for side-connection to fixture leads.

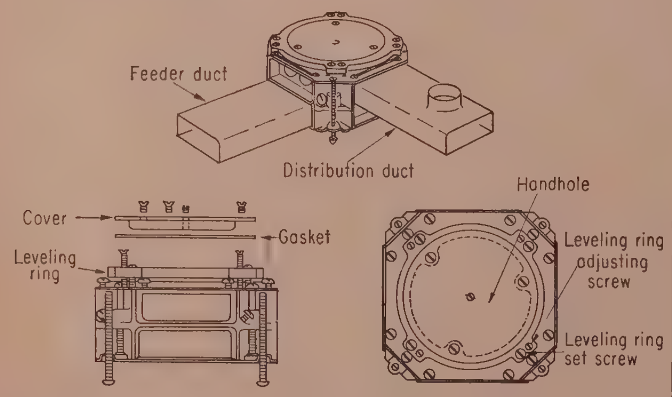
enclosed ceiling cavity is painted with an 80% reflectance white and, where luminous strips are lowered to underpass obstructions such as beams or air conditioning ducts, lamps are operated at 200-ma to keep overall brightness values of the translucent ceiling fairly uniform. This 120-volt luminous ceiling is segregated into four circuits, each equipped with a separate dimmer and each handling one quarter of the 4½-kw installation.

Over the central, public section of the banking space, illumination is generally provided by adjustable louvered PAR-38 floodlights recessed into a dropped acoustically-plastered canopy, while numerous additional fixed-focus higher-output R-40 downlights are placed above areas of heaviest traffic, carpeted stairs leading to the main lobby, stand-up checkwriting desks which are constructed around paneled building columns, and seasonal display areas.

Local lighting for tellers' desks is obtained from fluorescent strips concealed beneath pass-through counter gates, while teller positions are also equipped with under-counter wall-flush convenience receptacles, "holdup" signals that silently inform remote guard stations of attempted robbery, and telephones wired via an underfloor duct system.

Two-level Duct System

The underfloor communication duct system installed in office areas is also unusual in that ducts (steel) are approximately 20% oversized in normal cross-section to provide greater capacity, while junction boxes are special universal 2-level assemblies having double openings on all four sides (eight openings in all) which may be blanked off by box-closures when not in service. The lower level of ducts is used generally to carry feeders from panels while the upper level is used for local distribution. Connections between surface outlets and duct inserts are simply established by, (a) using a magnetic battery-operated finder equipped with rotating indicating disks and signal lights to trace direction of duct runs and locate steel insert caps, regardless of whether caps are flush with finished floorslabs or are buried beneath cement skin coverings, (b) breaking the concrete coverings with a ball hammer so that inserts will be exposed completely and insert covers can be removed, (c) pulling wire through ducts and open inserts, insert adapters, housings and nipples and finally, (d) securing outlet housings.



UNIVERSAL junction boxes with double duct openings on each side can be adjusted in height by readily-accessible leveling screws, while 2-level choice for duct connection permits flexibility in layout and for underpassing reinforcing steel or other obstructions. Duct openings in JB can be blocked off when not in service.

In cases where floor outlets are desired in locations where preset duct inserts do not exist, placements are established by first locating ducts as previously described, cutting the floor covering and chipping the concrete skin, then using a power hole-cutter to pierce the ducts. An expansion jig is then used to roll duct edges outward around special insert collars, after which wiring and outlets are installed in the same manner as noted above.

By using a universal type JB, duct patterns are practically unlimited and changes in elevation (to underpass reinforcing steel or similar obstructions) may be made at will either at duct turning points or in straight runs. And, since duct components include a variety of couplings, supports, expansion joints, conduit adapters, wall and

BRANCH CONDUITS carrying 277-volt circuitry for lighting are run upward from local distribution panels, to be contained in floorslabs for lateral routing to outlet boxes. Lipped channels and bolted clips support horizontal runs of EMT against concrete-block wall of electric closets.

POWER PANEL for building-service equipment is flanked by square raceway extensions which in turn are nippled up and down to connect with breakers, starters and control equipment related to remote motorized equipment. Liberally-dimensioned panel gutters and removable covers of wireways facilitate wiring.

floor elbows, offsets and panel connectors, considerable flexibility of layout is possible.

As indicated by an accompanying sketch, readily-accessible leveling screws permit fast, accurate adjustment of JB covers as well as of boxes and intervening duct supports, while insert collars of various heights permit outlets to be established either in lower or upper ducts placed in slabs of various thicknesses.

In several instances where underfloor wiring is concentrated, duct runs are 3-level; the upper *two* ducts then being used for local distribution. Where wiring is less extensive, single-level ducts are used, with junction boxes nippled down through floorslabs to connect with under-slab mounted circuits.

Receptacle Placement

On upper floors, floor receptacles pertaining to 120/208-volt power may be positioned above floor boxes or "miracle cans" placed in a fixed pattern on all typical floors in the 10-story office-tower sections.

As noted by a sketch showing details of floor and ceiling outlets, these fibre cans (2-in. OD; 5¼-in. height) were secured to floor forms prior to pouring of slabs and, after forms were removed, can bottoms were coupled to exposed boxes secured to slab undersides. Then, to complete the installation, the inch-thick concrete covering remaining over the cans was drilled to receive the drive-fit of short nipples to which floor receptacles were secured.

Since fixed-pattern floor boxes set flush with finished floor slabs are nippled downward to also connect with exposed under-slab boxes, the power distribution system was simply completed by connecting exposed boxes via conduit, then establishing additional under-slab runs back to distribution panels located in electric closets on the various floors.

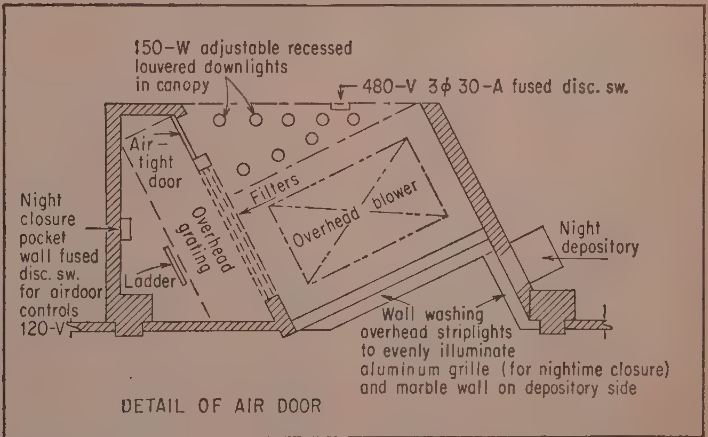
Outlet boxes serving overhead lighting installations were handled differently, for in these instances branch conduits (containing 4-wire 277-volt circuitry) were run from distribution panels to be contained within slabs, then fanning outward to outlet boxes set bottom-flush on slab forms. These flush boxes subsequently were equipped with lower extension sections to increase wiring space and to facilitate direct side-connection with flexible conduit leads extending to canopies of lighting fixtures recessed into suspended ceilings.

Fixtures installed in typical offices are 2- by 4-ft Mobilex units of shallow design (less than 5-in. high); equipped with Cleartex low-brightness plastic diffusing panels; containing housings for ballasts, individual fuses and wiring; and detailed to mount either two or three 40-watt lamps which, in this installation, are the recently-developed, 3500-lumen Premium-3 cool-white tubes.

A minimum lighting level of 50-fc was established as a basic standard, although in actual practice this minimum was consistently exceeded throughout the building. Also, in designing the electrical system as a whole, a combined lighting and receptacle load of 5 w/sf was provided for; with a 200-amp breaker serving each 10,000-sq-ft floor and with feeders distributing power at 480/277 volts to each electric closet and to premises of all major tenants on lower floors. Provision of 120/208-volt power for receptacle use is accomplished locally through dry-type transformers, while emergency service at 120/208 volts is provided by a separate utility entrance; automatic transfer to said service occurring when normal voltage is interrupted.

One additional comment pertains to electric radiant baseboards, mounted around the periphery of the first-floor bank, which are raised slightly above the floor level to permit placement of multi-outlet wireways and duplex receptacles on 3-ft centers beneath.

This installation was engineered by Gilbert H. Mandeville, PE, and Gudmund B. Berge, architect, both of Seattle, with architects Emery Roth and Sons of New York serving as consultants.


150–W adjustable recessed louvered downlights in canopy
480–V 3φ 30–A fused disc. sw.
Air-tight door
Filters
Overhead blower
Night closure pocket wall fused disc. sw. for airdoor controls 120–V
Overhead grating
Ladder
Night depository
Wall washing overhead striplights to evenly illuminate aluminum grille (for nightime closure) and marble wall on depository side
DETAIL OF AIR DOOR

AIR DOOR provides unobstructed threshold to interior of building while excluding dirt, dust, rain and temperature extremes by means of downflowing curtain of slowly-moving air that obtains its direction from sensing vanes that automatically note velocity, and rotate to neutralize flow of inrushing air currents.

The T-Connected 3-Phase Transformer

An analysis aimed at solving any "mysteries" of the 3-phase "T" transformer. Design, operation and application features of this compact unit are covered.

By **Paul A. Vance,** *Application Engineer, Specialty Transformer Dept., General Electric Company, Ft. Wayne, Ind.*

HORSEPOWER-per-man ratio is increasing in our factories. Watts-per-square-foot is going up in our industrial and commercial lighting. Business offices are using more motor-operated bookkeeping equipment. Power requirements are rising.

To supply the large blocks of kilowatts needed for all this, two trends seem to emerge. First, an increase in power distribution voltage levels with transformer step-down at point of usage is bringing transformers, machines and people closer together. Second, 3-phase power right to the point of usage is becoming more common.

Both trends focus attention on the transformer; admonish it to go "3-phase," and occupy as little floor space as possible. More than one transformer manufacturer has considered the various ways in which a 3-phase transformer can be built and is producing a T-connected unit.

For a minimum amount of material per given kva size, perhaps the 3-phase core offers the best design. Normally, this is a "horizontal" rather than a "vertical" device and occupies floor space out of proportion to its height. This is especially true in sizes that require ventilation in the windings for proper cooling. A vertical assembly of three single-phase units could solve the floor space problem, but might cost more to manufacture.

THREE-PHASE T-connected transformer mounted on steel building structure takes no more than width of column.

COMPACT DESIGN FITS vertical support at machine; permits 3-phase transformer to be installed at or near loads.

While the 3-phase, T-connected unit might require more material than the conventional core and coil design, it offers such an advantage to the user that it is being considered here. From an installation viewpoint, the dimensional advantages are evident in Table I. Actual figures comparing "kva physical size" of the 3-phase core type and the T-connected type unit will be given later.

From a construction standpoint, the small power (range up to about 15 kva, 3-phase) T-connected 3-phase transformer can be built with exposed cores similar to the common type of single-phase unit. The two cores and coils ("main" and "teaser") are mounted one above the other with a sleeve or spacer between, a wiring compartment at one end, and a protective covering on the other end.

This compact, 3-phase transformer assembly can be mounted on a column, a vertical pipe, or a vertical frame member of a machine.

3-Phase Transformer Circuits

Since the unusual circuitry of the T-connection has raised many questions, its advantages and disadvantages will be explored. A brief review of the conventional and T-connections is in order before discussing the various characteristics of the T-connected unit.

Delta-Delta

The delta-delta or delta-wye has one winding (usually the primary) in delta, so that there is a coil across each pair of 3-phase lines.

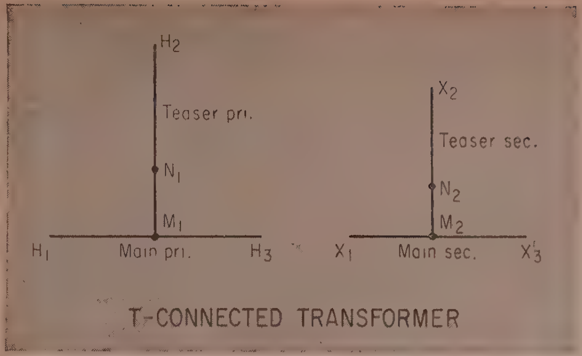


FIG. 1—T-connected transformer has "main" and "teaser" windings connected as indicated.

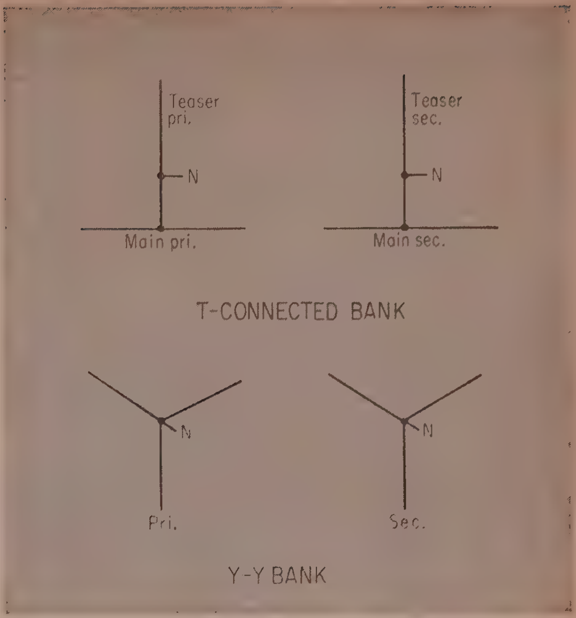


FIG. 2—Comparative diagram showing connections of a T-bank and Y-Y bank of transformers.

Table I
DIMENSIONAL COMPARISON OF SMALL 3-PHASE TRANSFORMERS

	Conventional Design					T Design				
	Dimensions—in.			Sq in. Floor Space	Cu in. Total	Dimensions—in.			Sq in. Floor Space	Cu in. Total
KVA	Height	Width	Depth			Height	Width	Depth		
6	15	18-1/2	8-11/16	160	2400	22-1/2	8-5/8	7-3/4	67	1510
9	17-1/4	18-5/8	11-5/16	211	3640	25	8-5/8	7-3/4	67	1675
15	19	24	13-1/2	324	6150	26-1/4	11-1/4	9-7/8	111	2920

Notes: Dimensions are of well known makes with smallest of each rating selected.
For installation purposes, narrow width and shallow depth of T-connected unit may be more important than its smaller volume.

Third harmonic exciting currents circulate in the delta. Voltages are stable. The neutral point of the Y does not shift except for a small impedance drop.

Wye-Wye

The Y-Y connection is not recommended except in special cases, and preferably with the primary neutral connected solidly to the neutral of a 4-wire supply. Since there is a tendency to compare a T-connected unit to a Y-Y unit, their similarities and differences will be discussed later.

T-Connection

The T-connected unit consists of a "Main" and "Teaser" transformer with connections shown in Fig. 1.

The "Main" transformer primary is connected solidly between lines at H_1 and H_3. Its mid-point M_1 established halfway between H_1 and H_3. The windings on each side of this point are "closely coupled" to each other as far as reactance is concerned, so that the point is not inclined to wander back and forth with various load currents.

The "Teaser" is connected between the other line, at H_2 and H_3. The secondary is connected in a similar manner. The secondary main and teaser windings could be left separate and would produce a 2-phase voltage. The points marked N are ⅓ up on the teaser, and are at the same distance from each of the three terminals. Therefore, they can be used as a neutral, subject to certain precautions as will be noted later.

It can be seen from Fig. 1 that the main transformer operates as (because it is) a single-phase transformer. Thus, with a load connected to X_1 and X_3 the current in the primary coil (H_1 to H_3) and in the secondary coil (X_1 to X_3) will be the same as that in any single-phase transformer. The exciting current is also comparable.

The midpoint of the main, to which one end of the teaser is attached, is *electrically* midway between the ends of the winding. This is very easy to accomplish at no load. However, under some conditions of load, IZ drops try to move this point to one side or the other. Right here is one of the important virtues of a well designed main, and could be one of the stumbling blocks or "disadvantages" of a poorly designed unit. No matter what happens, it is the duty of the main to hold the midpoint close to the "midpoint." This is done by having the two halves of the coil closely coupled to each other. The reactance between these two halves is called interlacing reactance.

The rest is easy. The teaser connects from this "land mark" to H_2 (and X_2) and operates just as any single-phase transformer. However, any current that flows in the teaser must go "someplace," and it can only flow into the main. From this midpoint, any teaser current flowing in one direction will force the equivalent of an equal current in the opposite direction, either in the same winding or in another one. The two opposite ampere-turn values "neutralize" each other in the core.

Thus, points M_1 and M_2 are fixed

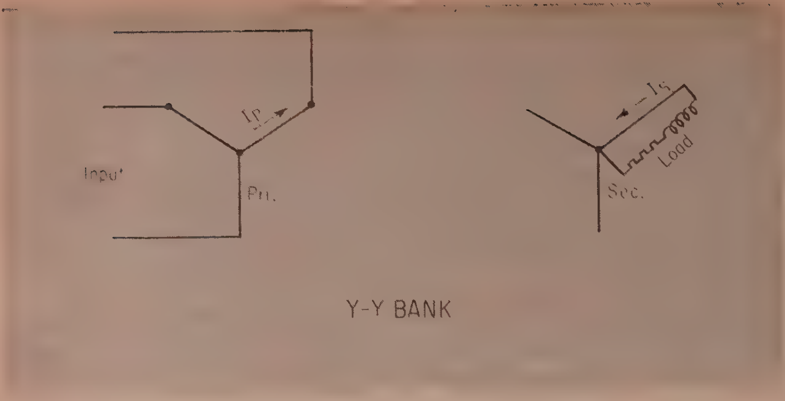


FIG. 3—Line-to-neutral loads cause unbalanced L-N voltages in Y-Y connected transformers.

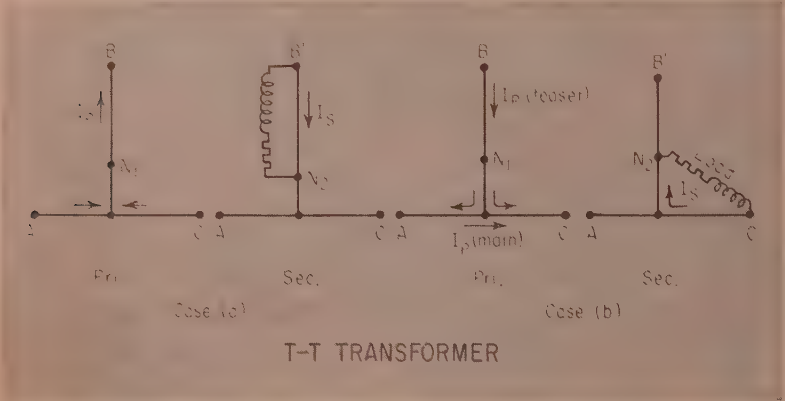


FIG. 4—T-T transformer line-to-neutral loads cause no unbalance of L-N voltages.

within reasonable tolerances. Points N_1 and N_2 are also "fixed." This means that the neutral is "stiff" and that loads from line-to-neutral can be applied, and that an unbalance in these loads will not cause the neutral to shift.

A shifting neutral could be disastrous. Suppose a single light bulb is connected from neutral to one line and a greater load to the other lines. If the neutral shifts, this one bulb can easily be over-voltaged and will burn out.

T and Y-Y Comparison

This brings us to a comparison of Y-Y-connected transformers or banks with the T-connected unit. Many people erroneously believe that they are similar. True, a similarity exists, in that both have a neutral point that can be brought out and both have zero phase displacement between primary and secondary (see Fig. 2). This is not true of the Delta-Y, which is the normal connection if a neutral is desired in one of the windings.

A very important difference between the T-T and Y-Y connection is the "stiffness" of the neutral.

Line-to-Neutral Loads

In the Y-Y transformers, any attempt to draw a load from any line-to-neutral would result in a severe unbalance of L-N voltages (see Fig. 3). Load current I_s (secondary) effects primary I_p as shown. This current must come from one or both of the other two primary legs. Since these legs are carrying exciting current only, any attempt to force more current through them would raise the voltage across them. The voltage across the loaded phase, therefore, decreases.

In the T-T transformer, line-to-neutral loads do not cause the voltage to unbalance. These transformers can be loaded L-N without any difficulty. Fig. 4 Case (a) shows current relations if the L-N load is in the teaser. Note that primary currents can flow, since they neutralize each other. Case (b) shows an L-N load from one end of the main to neutral. Note that N is $\frac{1}{3}$ the distance from the midpoint of the main to the top of the teaser. The current I_s in Case (b) thus requires a current $I_{p\,(T)}$ of $\frac{1}{3}$ the equivalent value. This current divides in the main as shown. The main primary current $I_{p\,(M)}$ is equivalent to I_s when the turns ratio is taken into consideration. Current in line A is, therefore, the vector difference of $I_{p\,(M)}$ and $\frac{1}{2}\,I_{p\,(T)}$. Current in line B is equivalent to $\frac{1}{3}\,I_s$, and in line C slightly more than the equivalent of $\frac{1}{2}\,I_s$. Neutral point N does not shift.

Third Harmonics in Y-Y

Normally, the exciting current of any transformer must have a third harmonic component to produce a flux wave approximately sinusoidal in shape matching the induced voltage wave. The third harmonics of the three line currents of a 3-phase system are in phase with each other and, therefore, cannot flow in an ungrounded Y primary of a Y-Y connected transformer (see Fig. 5). Therefore, if the exciting current cannot have a third harmonic, the flux wave and induced voltage wave must have harmonics in them.

With no transformer or system ground, these harmonics can cause high voltage stresses in the transformer (between neutral and ground). This voltage can also appear as line-to-ground voltage if the line capacitance-to-ground is greater than transformer winding capacitance-to-ground.

If the neutral of the transformer is grounded with system neutral isolated, the third harmonic voltage appears as a single-phase voltage between all three lines and ground. This could cause capacitance current to flow from all three lines to ground. A condition of resonance could exist if the capacitive reactance and inductive reactance are equal. This could occur with long lines connected to the transformer. High voltage and currents could exist in the system.

If both transformer and system neutrals are grounded, third harmonic currents can flow and third harmonic voltages disappear. However, the third harmonic currents flow in one direction in the neutral and in the other direction in all three lines.

In all three cases, telephone interference is possible. Under some conditions it can be very bad.

Third Harmonics in T-T

None of the above problems exist in the T-connection. The main transformer is connected solidly across two lines and has the same exciting current as a single-phase transformer. The precautions necessary to prevent normal 60-cycle current from causing telephone in-

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terference will take care of the harmonics, as they flow in the same lines, out in one and back in the other, during any half cycle. The teaser exciting current divides in the main transformer winding. It can do this without difficulty as the ampere turns cancel. Since the interlacing reactance (reactance between section A and B of Fig. 6) is low, any teaser current can flow without difficulty, as noted above.

It is evident in Fig. 6 that any harmonic components of exciting currents can flow freely in the lines. Furthermore, they cause no zero-sequence current. Therefore, they would cause no telephone interference that could not be controlled by proper positioning of the phase lines.

T and Delta-Delta, Delta-Y Comparison

While it has phase displacement similar to the Delta-Delta connection, the T-connection has one advantage—it can provide a neutral connection for either or both circuits. To obtain the neutral of the Delta-Delta banks, zig-zag grounding transformers must be used. Or, if the neutral is needed in one of the circuits only, the Delta-Y circuit may be used but the phase displacement between primary and secondary is no longer zero.

Fixed Neutral from Delta-Y

One of the uses of the Delta-Y connection is to establish a fixed neutral in the Y winding (not possible in YY-connected circuits but possible in the T-connection, as discussed above).

The Delta-Y bank in Fig. 7 has a load on N-C^1, which causes a corresponding load current in primary phase BC. Since B and C are connected directly to supply lines, the load is properly handled with only the impedance drop in the windings, and there is no tendency for the neutral to shift with respect to terminals A^1, B^1 and C^1.

A comparison of Fig. 7 with Fig. 4 will show that both circuits are equally good, as far as establishing the neutral is concerned.

Exciting Current 3rd Harmonics

In the Delta-Y and Y-Delta circuit, the necessary third harmonics can circulate in the Delta, thus providing essentially sine wave flux and induced voltage. It is interesting to note, however, that when the transformer is connected Y-Delta (Fig. 8) the distortion in voltage wave shape evident in the Y-Y unit (Fig. 5) never completely disappears.

The solid arrows in Fig. 8 represent third harmonic current circulating in the secondary. The voltage producing these currents is the third harmonic distortion in the line-to-neutral voltage of the primary. The very undesirable voltage distortion (Fig. 5) is now short circuited by the closed-Delta winding and is reduced to a very low, usually negligible, value. It is affected

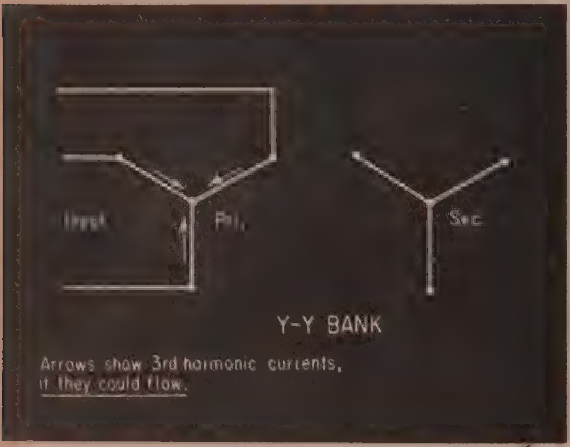

FIG. 5—Third harmonic currents in ungrounded Y-Y transformers can cause high voltage stresses in unit.

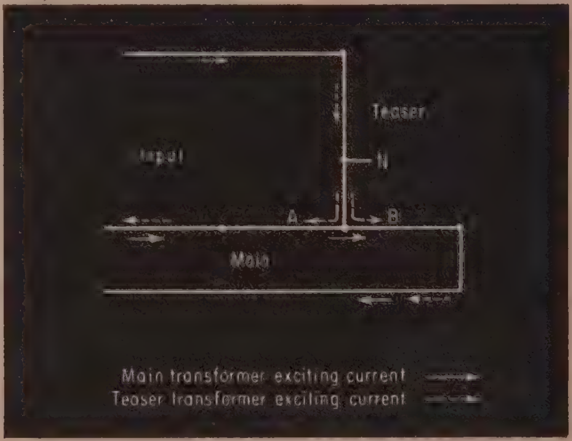
Teaser
Input
N
A
B
Main
Main transformer exciting current
Teaser transformer exciting current

FIG. 6—Harmonic components of exciting currents can flow freely in lines of T-connected transformer.

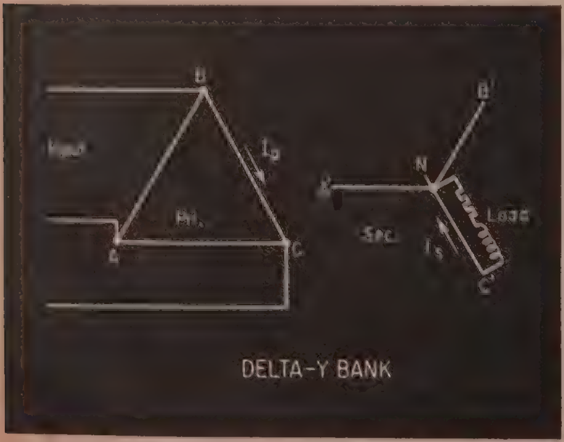

FIG. 7—A fixed neutral is established in a Delta-Wye transformer connection.

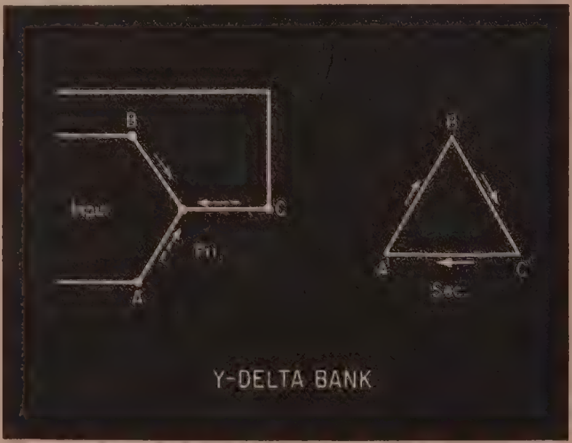

FIG. 8—In Y-delta bank undesirable harmonic voltage distortion is short circuited in closed-delta secondary winding.

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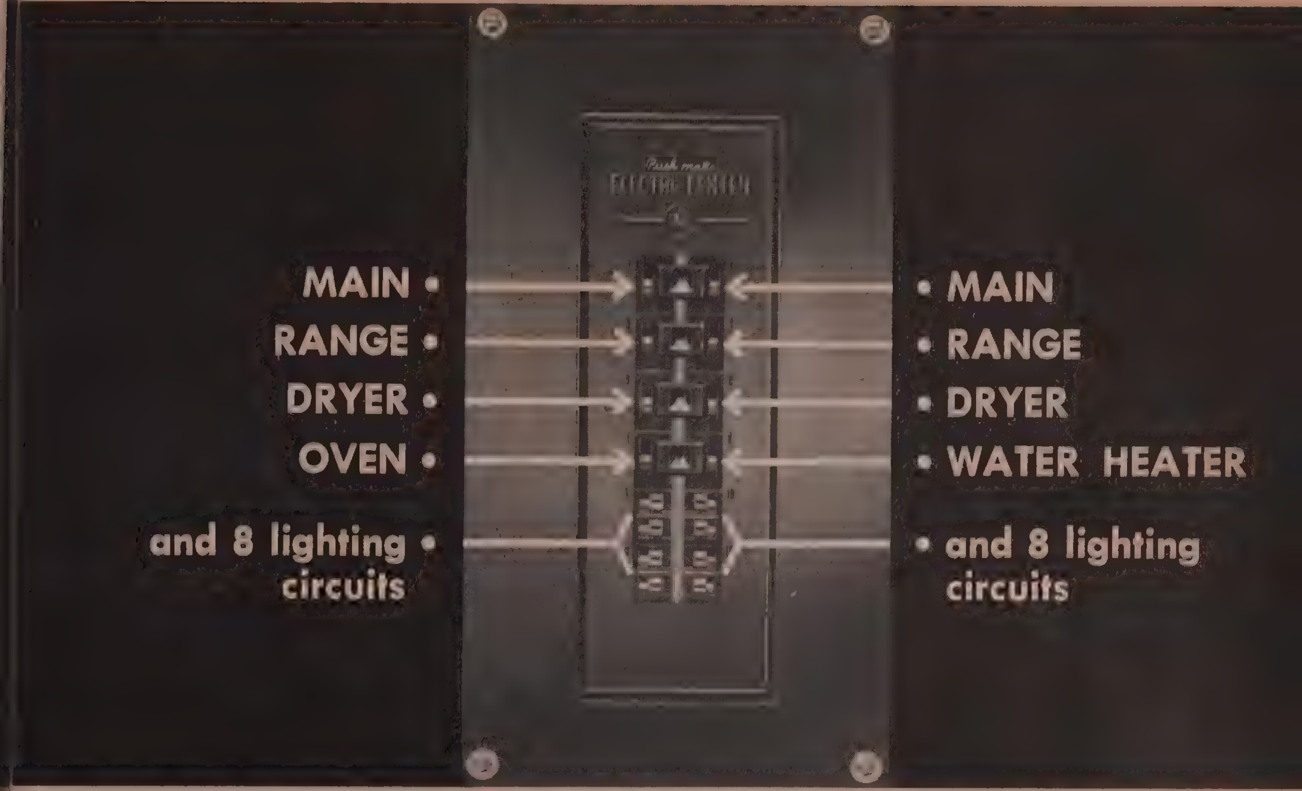

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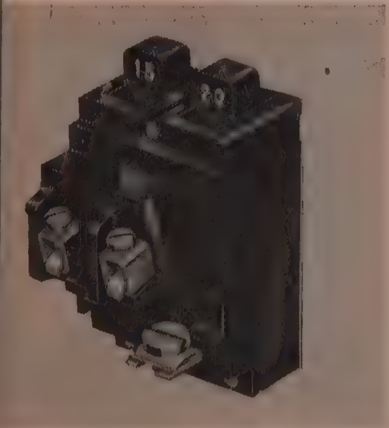

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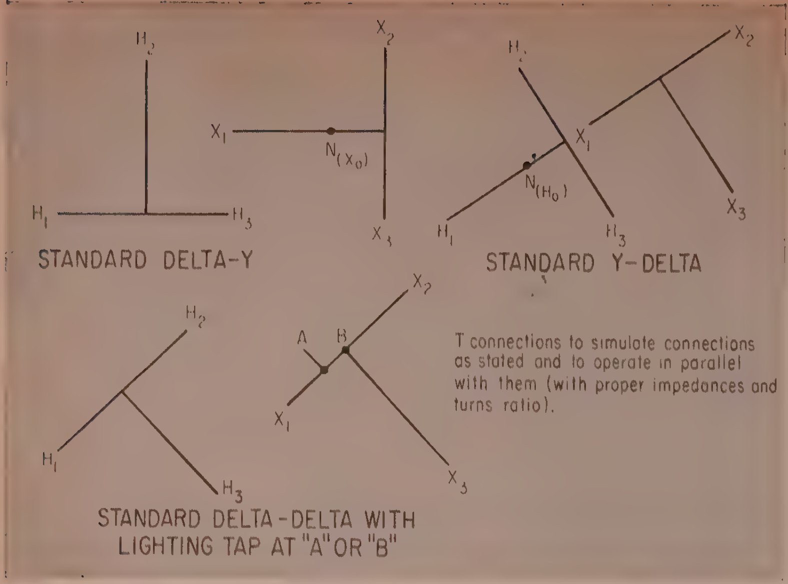


T connections to simulate connections as stated and to operate in parallel with them (with proper impedances and turns ratio).

FIG. 9—Other T-connections can be made to simulate the standard transformer connections indicated.

by the "coupling" or impedance between primary and secondary and by the resistance or impedance of the secondary winding itself.

In some cases this distortion has been known to cause difficulty, as described above for the Y-Y circuit, but it can be neglected in the small sizes of transformers being considered here.

In this respect the T-connection is at least as good as, or better than, the Y-Delta circuit.

Y-Delta or T on 4-Wire Circuit

A word of caution must be introduced here. If a 4-wire voltage supply is connected to the Y-winding of a Y-Delta Transformer or to the primary of a T-connected transformer, and *if the neutral wire is connected to the neutral of the transformer*, it is possible that the transformer may try too hard to hold the neutral in position. If the neutral of the supply deviates from its proper position, due to regulation caused by other loads, the transformer will try to correct this. Neutral current will flow from the transformer. In the Y-Delta unit, current will circulate in the Delta.

A small transformer could "burn itself up" trying to hold the neutral of a large system. Thus, *it is not advisable to connect the neutral of the Y-Delta or T-transformer to the solid neutral of the supply.* This is not true of the Y-Y transformer. For normal conditions of operation, the neutral of the Y-Y transformer primary *should* be connected to the solid neutral of the supply.

Voltage Regulation

Voltage regulation, from no load to full load, in the bank of conventional three-phase core type construction is usually higher than that of the T-bank, which usually consists of main and teaser of the exposed core, single-phase construction. This type of construction usually has % IR and % IX values in the order of 1 to 2%, whereas the 3-phase core construction usually has higher reactance resulting in poorer regulation at 0.8 PF or lower PF loads.

If the Delta-Delta bank consists of three units of essentially the same construction as the main and teaser units, the regulation will be essentially the same, discounting the fact that the main and teaser units are larger, and larger units of the same construction usually have better regulation.

A poorly designed T bank could have unequal regulation on the different phases, but this can be held to a negligible value in a good design. The regulation is balanced when the regulation of the main is equal to that of the teaser plus that caused by the interlacing reactance and resistance.

KVA Physical Size

Assume the kva physical size of the transformer is defined as: Primary Volts × Amperes + Secondary Volts × Amperes, the sum divided by two and this result divided by 1000. Then, a comparison of the physical size (equivalent kva) of the Delta-Delta bank and the T-bank may be made as follows:

Each leg of the Delta will have E_{Line} across it and will have $I_{Line}/\sqrt{3}$ through it.

Total equivalent kva, then, will be:

$$E_L \times I_L/\sqrt{3} \times 6 \div 2 \div 1000 = \frac{\sqrt{3}\,E_LI_L}{1000} = \frac{1.732\,E_LI_L}{1000} \quad (1)$$

A Delta-Y or Y-Y bank would work out to have the same equivalent kva.

For the T-T connected unit:

Main transformer equivalent kva is:

$$E_LI_L \times 2 \div 2 \div 1000 = \frac{E_LI_L}{1000} \quad (2)$$

Teaser equivalent kva is:

0.866

$$E_LI_L \times 2 \div 2 \div 1000 = \frac{0.866\,E_LI_L}{1000} \quad (3)$$

Equivalent kva of the T-T bank equals

$$(2) \text{ plus } (3) = \frac{1.866\,E_LI_L}{1000} \quad (4)$$

Comparing the Delta-Delta bank (1) with the T-bank (4) we find that the Delta-Delta bank is a little smaller in equivalent kva (1.732 EI compared to 1.866 EI). However, from the standpoint of actual physical dimensions (width, depth, height), the T-T unit is much smaller when the main and teaser are mounted together, one above the other, in a single assembly. See Table I for comparison.

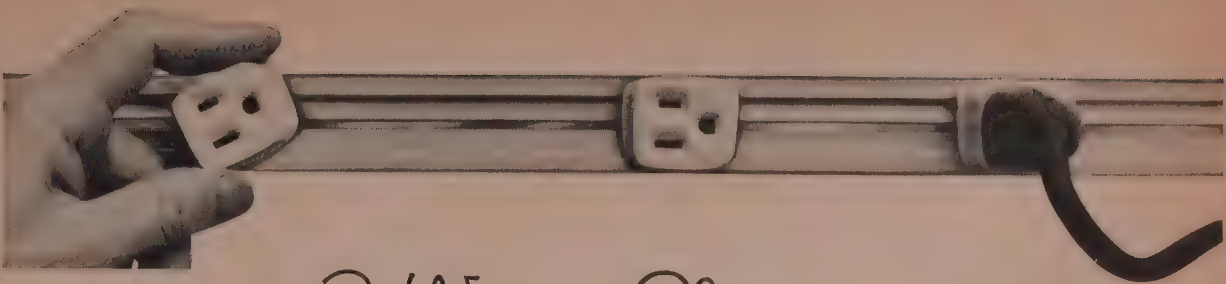
Other Connections

While the normal T-connection is similar to Figs. 2 and 4, other connections are possible. Some of these, together with the conventional circuits they simulate, are shown in Fig. 9.

When properly connected, and with matching impedance and turns ratio, the T-connected unit may be paralleled with units of other constructions.

The T-connection is a practical way of obtaining 3-phase operation in a compact transformer unit. It is virtuous in most respects, bad in very few, and good for almost any application.

With the growing demand of higher voltage distribution systems, and the need for more compact design, T-connected, 3-phase transformers are bound to become more popular.



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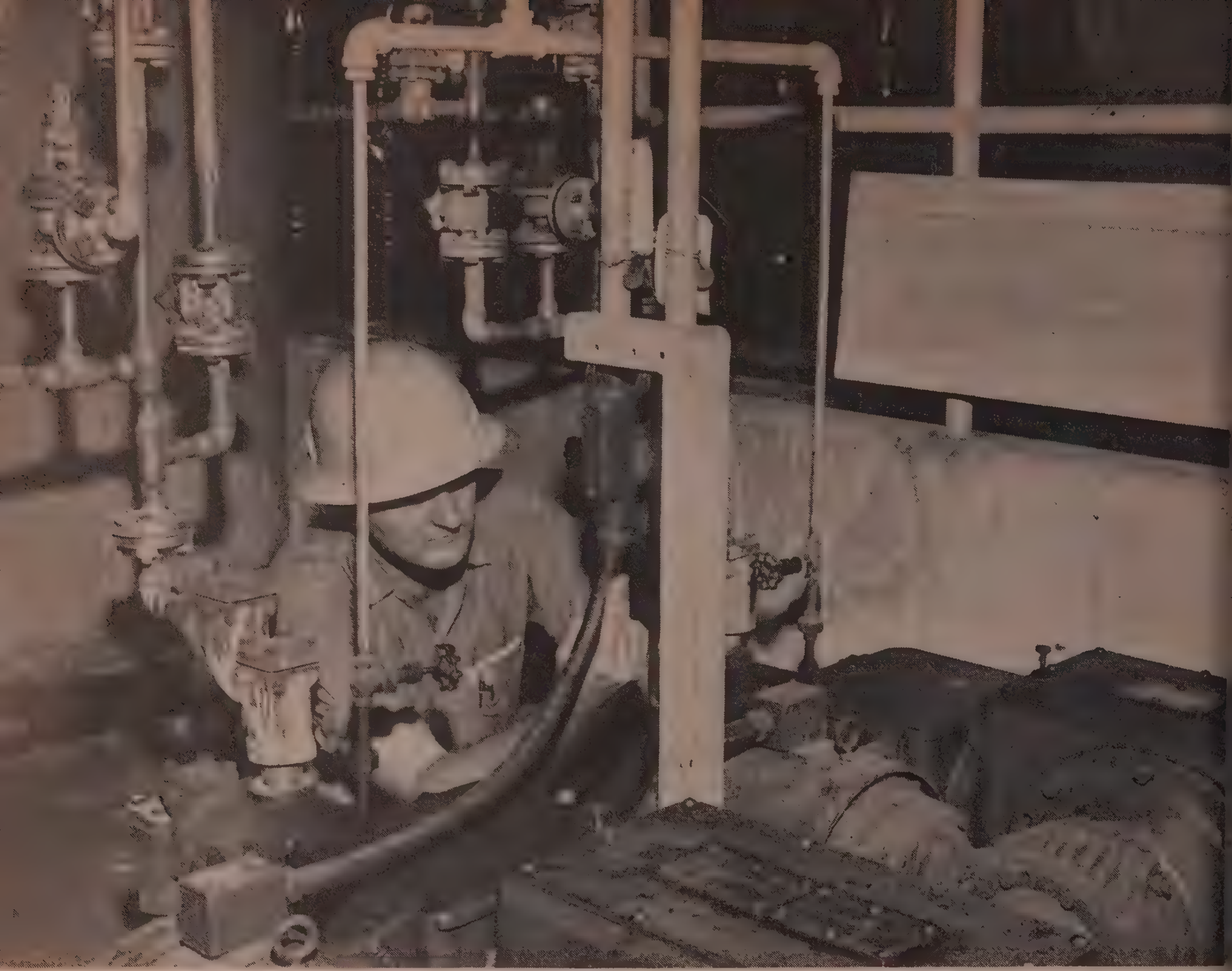
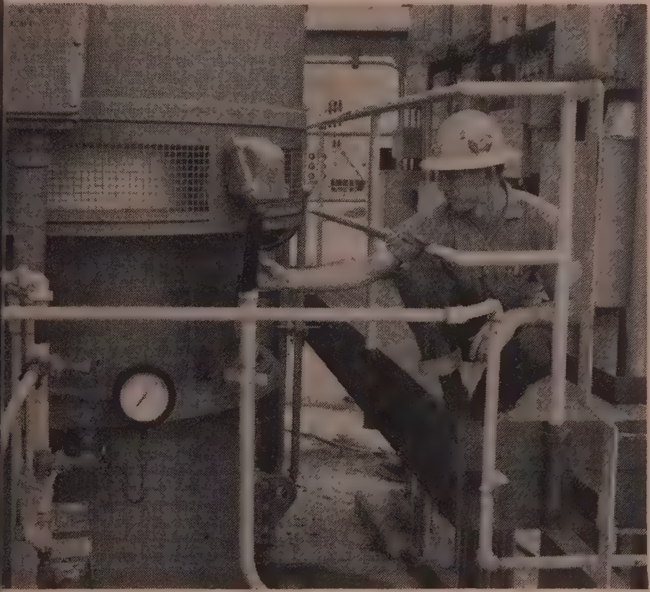


SULFURIC ACID, FUMES AND WATER would knock out these pump motor leads in short order if they weren't protected in ¾" Sealtite

HEAT AND DUST can't hurt the control wiring leading to this bank of soot blowers because it's protected in 3" Sealtite.

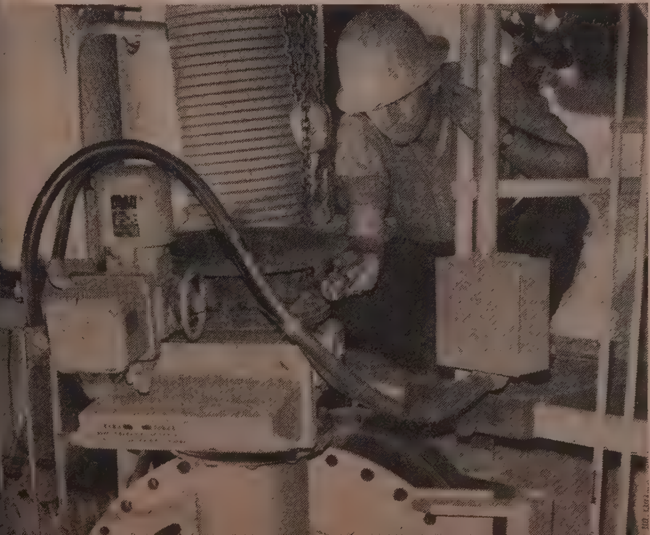
CHEMICAL FUMES AND WATER are the main reasons w
these sulfite pump motors are encased in ¾" Sealti

HEAT, STEAM, VIBRATION AND WEATHER would ruin wiring to these soot blowers if not protected in 2″ Sealtite.



SALT SPRAY AND WEATHER buffet these circulating water pump motor connections all year round. But 3½″ and 1¼″ Sealtite keep wiring dry and trouble-free.

HEAT, COAL DUST AND VIBRATION would constantly threaten this control wiring connecting coal gates and motor leads if it weren't protected in 1″ and ¾″ Sealtite.



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Look over the examples to see how Tampa Electric takes full advantage of Sealtite. One of them might suggest a way you, too, can increase your wiring efficiency by eliminating potential trouble spots.

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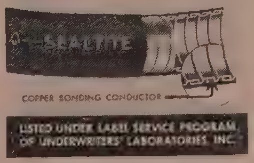
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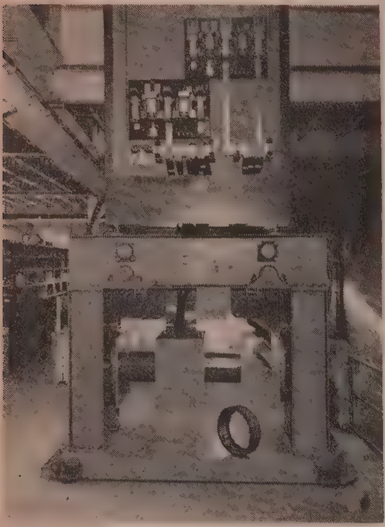
Drum rims are automatically fed to and installed on the duplex heater pole pieces. After a 10-second heating cycle, they are removed and automatically conveyed to the centrifugal die where the molten metal lining is poured from a hoist-mounted arc furnace. The pole pieces are part of a T-shaped movable center section which moves back and forth between two stationary L-shaped sections of the transformer primary core. The rim on the pole piece forms the secondary and is heated by induced currents when the circuit is closed. While the rim on one side is being heated, another rim is placed on the other pole piece and the heating cycle is repeated when the center section moves to the opposite stationary core assembly.

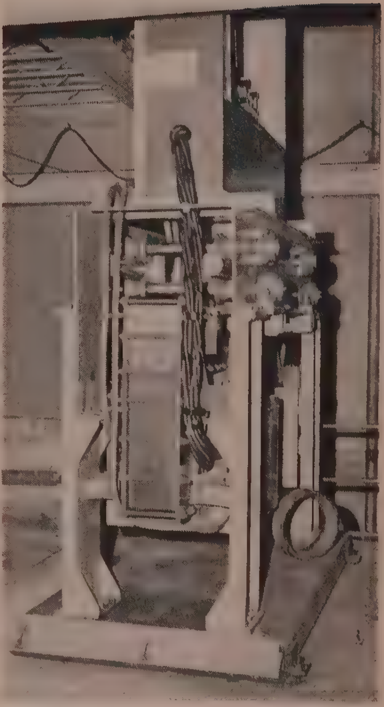


DUPLEX INDUCTION HEATER for automotive brake drums has control panel at top; has 10-second heating cycle. Center pole section, on which drum rims are placed, moves from side to side to complete primary transformer circuit when contact is made with stationary core on each side of machine. While drums (secondary circuit) are being heated in one position, other drums are placed on free pole-piece and cycle is repeated.

The movable center section is roller-suspended from the top of the transformer core supporting structure. Back and forth movement is provided by an air-cylinder system. Each half of the duplex heater is interlocked through automatic controls actuated by the centrifugal die mechanism as it calls for more drum rims.

Electrical equipment and circuits for this 5-ton induction heater were designed by Barker-Fowler's Mason V. Green and his engineering staff to match the frame design of the customer. A local steel fabricating plant built the frame. In addition to fabricating the transformer, B-F mechanics assembled and wired the complete machine in their motor service shop.

The transformer core for the 460-volt, 60-cycle unit was fabricated from six 1,000-lb coils of 11-in. wide, 29-gauge transformer lamination steel cut to 12 different lengths in power shears. Pole pieces were milled round on a Hydro-tel machine and the pole faces were milled parallel to reduce the air gap to a minimum.



END VIEW OF UNIT showing one of the L-shaped stationary transformer cores and roller-suspension of movable center T-shaped section. Air cylinders move center section back and forth.

Primary coil windings are pancake type. On each half of the unit there are one stationary and one movable coil series-connected to a size 5 welding contactor in the 460-volt, single-phase line on each half of the duplex machine.

Coil conductors were assembled with six bare copper ribbons and two rectangular copper tubes thoroughly coated with a one-element epoxy and taped with epoxy-saturated fibreglass tape. The completed coil was coated with epoxy, taped with glass fiber, given a finish coat of epoxy, placed between clamping plates, and baked to cure the epoxy.

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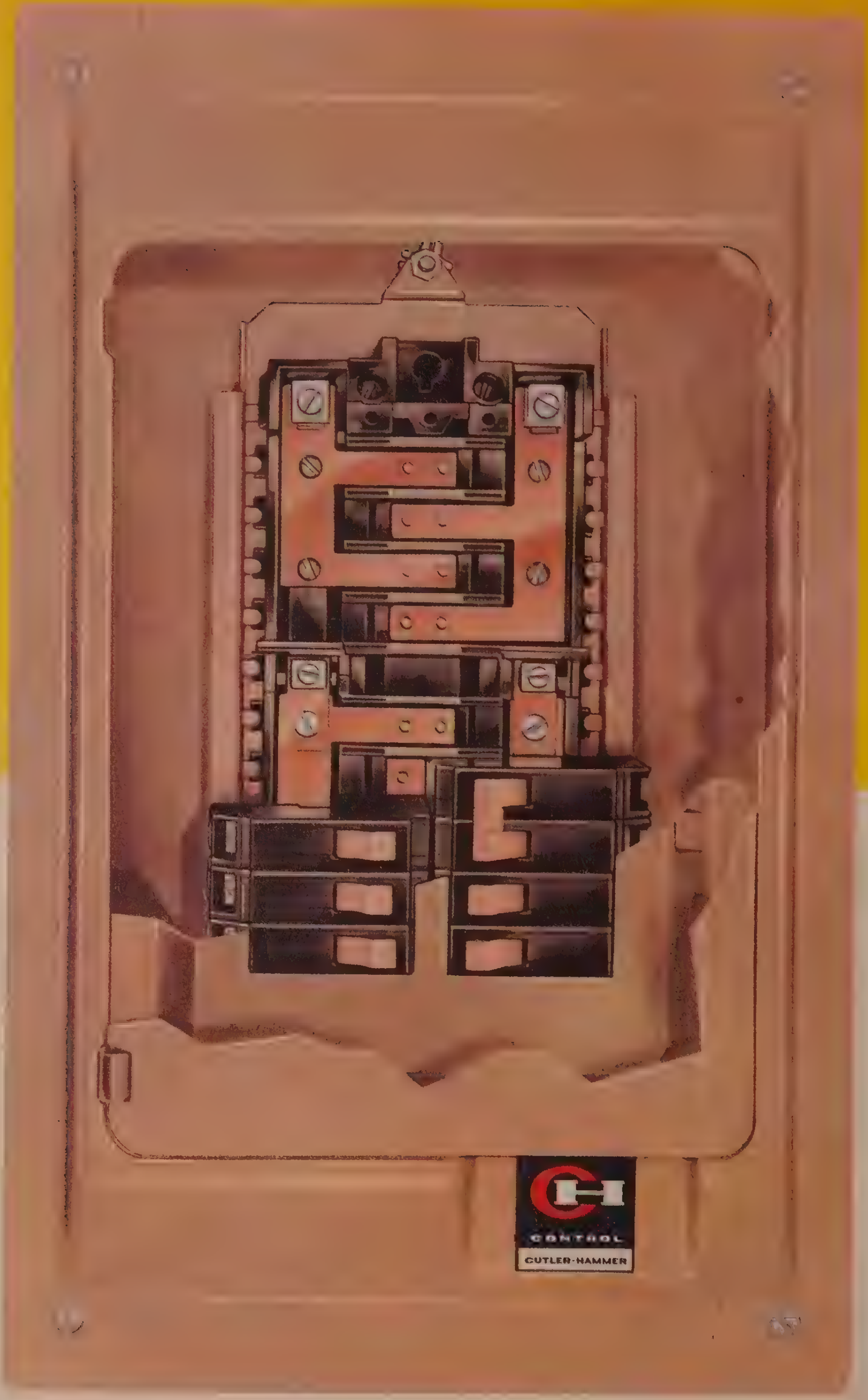
Radio, Electronics and Television Manufacturers Association



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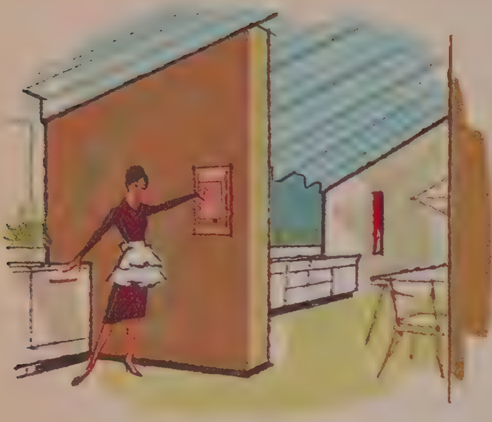

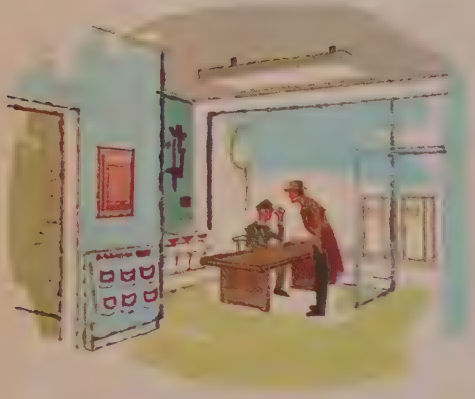

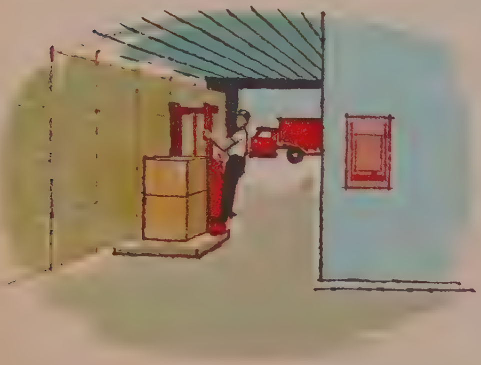

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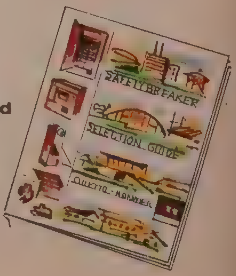

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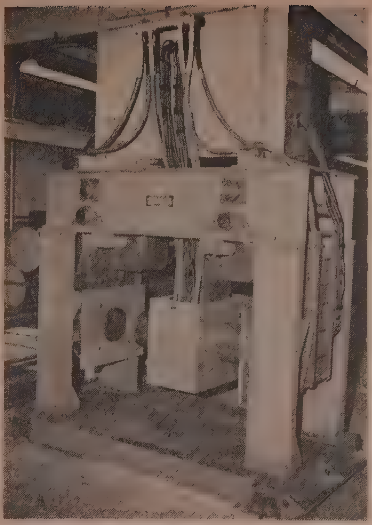
Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.



HOSE CONNECTIONS for water-cooled primary coils on stationary and movable cores terminate in fittings high up on back of control panel. System was designed to limit ground current through water system to less than 1 ma.

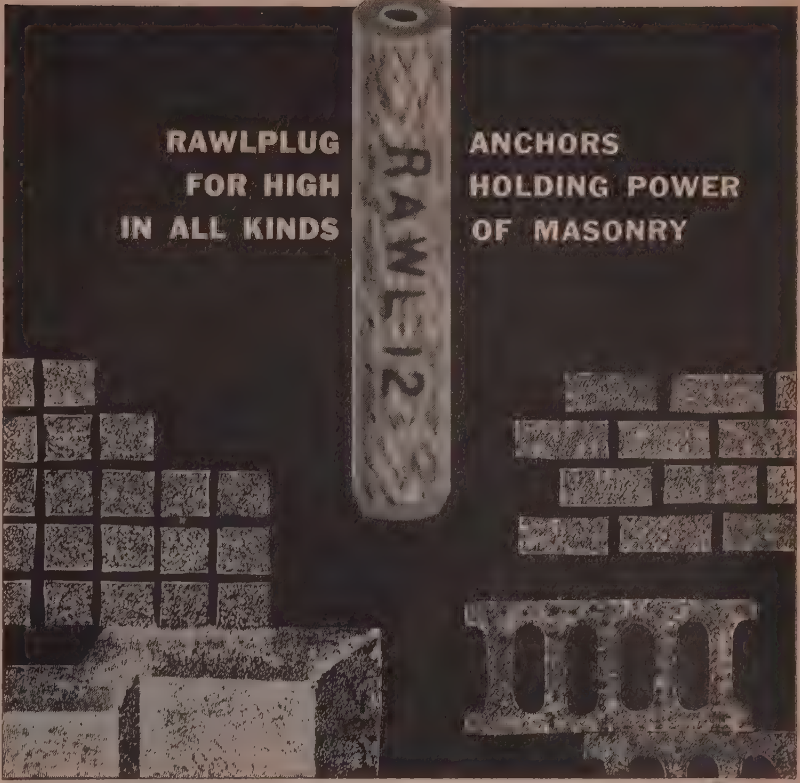
pressure without sweating of the conductors or the cooling system. Rubber hose connects the copper tubing in the coils to an intake and exhaust manifold placed high on the back of the control cabinet above the unit. This was done to permit installation of only safe lengths of hose and to limit the ground current through the water system to less than one milliampere.

Build Racks To Store Wire

Storage of small reels of appliance wire and partially used coils of building wire is a problem that every electrical contractor has to contend with. Not only is it necessary to have an adequate means of storing and de-reeling lengths of portable type cords (such as appliance cords, lamp cords and drop cords); it is most important that a means be devised to store the partially used coils of building wire returned from jobs.

The racks, bins or methods used for either purpose will vary between shops, but all serve to achieve a common goal—to provide a visible means of storage that does not require a great deal of usable floor space and at the same time is readily accessible. Convenience and space saving are not, however, the main advantages of these shop-built devices. Reduction in waste and time saving should be the basic end results.

ANCHORING AND DRILLING DEVICES FOR FASTENING ANYTHING TO MASONRY



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Throughout the beautiful and impressive Hilton Inn in New Orleans, modern Rocker-Glo switches by Pass & Seymour are on the job. Rocker-Glo is unique. It can be smoothly operated by pressing, rocking, rolling or simply nudging. Rocker-Glo is quiet in operation and it glows in the dark.

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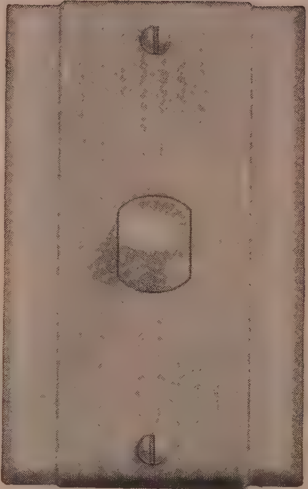
Write for free literature, Dept. ECM-66A



No. 2201 Rocker-Glo Switch

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P&S® PASS & SEYMOUR, INC.
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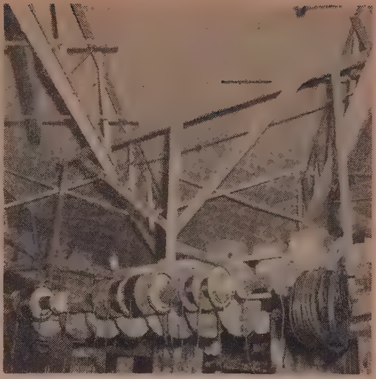
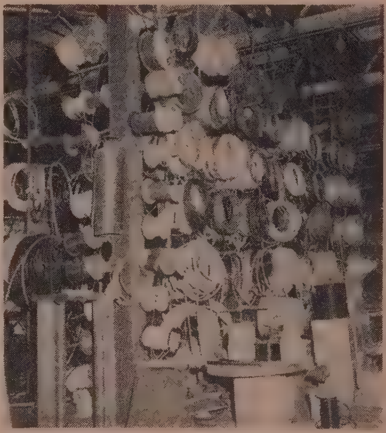
60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario



SLOTTED ANGLE FRAMING hangs from ceiling joists to support double rows of pipe-held reels that contain various sizes of portable cables plus all types of appliance cords. The ceiling-hung rack besides presenting a visual display of the various sizes of wire in stock doesn't take up valuable floor space.



VERTICAL PIPE-TYPE RACK constructed of ½-in. conduit is used to store partially used coils of small sizes of building wire returned to the shop from jobs. Each coil of wire is tagged as to its type and the number of feet of wire it contains. Owners say a great deal of waste has been eliminated since the construction of the rack because short ends and "scrap" coils of wire are now used up.

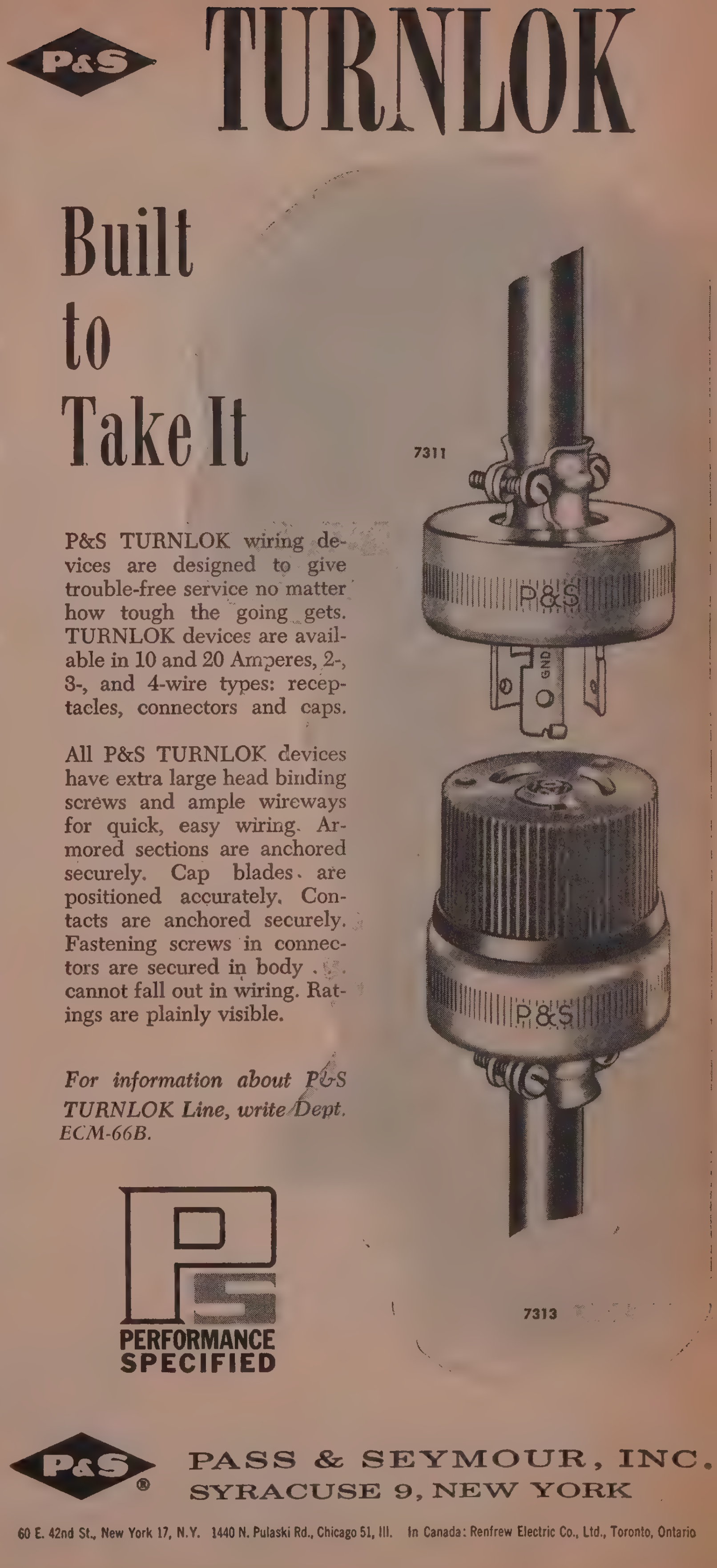
Here, for example, is how a contracting firm in Jackson, Mich. used two types of shop-constructed racks to solve the above mentioned problems of storing wire. For small reels (up to 18 in. in diameter) of portable type cords, slotted angle framing attached to the building's first-floor ceiling joists supports one 10-ft length of ½-in. conduit (for the lighter reels) and one 10-ft length of 1-in. conduit (for the heavier reels). The various reels are slipped onto either of the two lengths of conduit through conventional small-diameter holes in the reels' centers. The two back-to-back rows of wire reels supported by the slotted angle framing material were

LARGER RACK on left side of photo is constructed of 3/4-in. conduit and is used to store coils of larger sizes of wire. Rack on right side of photo is the rear view of the section constructed of 1/2-in. conduit. It is used to store partially used coils of smaller size building wire. Rack on left also details typical crossarm members.

installed to hang directly over a storeroom work bench. Mounted to one end of the bench (not seen in photo) is a hand operated wire coiling reel and measuring meter. Since the reels holding the various types of wire rotate freely on their supporting conduits, wire selected from any one of the reels can be pulled off, passed through the measuring meter, and wound on the coiling reel until the amount or length desired is obtained.

For storing partially used coils of building wire returned to their shop the Electric Maintenance and Repair Company has built two 12- by 14-ft sections of vertical pipe-type racks. The first rack, which is used to store smaller sizes of wire, consists of nine vertical 12-ft welded lengths of ½-in. conduit spaced on 20-in. centers. The nine conduit lengths are supported from a ceiling stringer by ½-in. pipe hooks which are threaded to the top ends of the conduits. The pipe hooks installed on the 12-ft sections of conduit are connected to ½-in. eye bolts that are threaded into beam clamps set 20 in. apart on the steel ceiling girder. For rigidity, and to keep the vertical conduits on center, each length is welded at its base to a 14-ft horizontal section of ¾-in. conduit that is anchored to the shop's concrete floor.

Jutting from the front and the back of each vertical section of conduit are six ½-in. pipe crossarms mounted on 18-in. centers. The crossarms, which are welded in position, measure 12 in. from center to each of their ends. It is these arms that the partially used coils of building wire are stored on. Before the coils are placed on the rack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P&S TURNLOK wiring devices are designed to give trouble-free service no matter how tough the going gets. TURNLOK devices are available in 10 and 20 Amperes, 2-, 3-, and 4-wire types: receptacles, connectors and caps.

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KRALOY PVC RIGID CONDUIT before encasement in concrete slab. Its mirror-smooth interior walls make fishing easier.

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NOTE THESE WEIGHT COMPARISONS (LBS.)

Trade Size	½″	1″	2″	3″	4″	5″	6″
KRALOY PVC	**15.0**	**29.0**	**63.0**	**131.0**	**187.0**	**253.0**	**326.0**
ALUMINUM	27.4	53.0	115.7	238.9	340.0	465.4	612.9
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arms, however, they are measured and tagged as to their type and the exact number of feet of wire that each contains. The ⅜-in. by 3-in. tips welded onto the ends of each arm at a 45 degree angle prevent the coils from falling off.

The second rack, which is used to store the larger sizes of wire, is located directly behind the first rack with just enough space between the two to allow for a pass-through aisle. This rack is built along the same lines as the one just described except for these modifications. Since the second rack is constructed to hold coils of large-size wire, it is built with ¾-in. conduits spaced on 24-in. centers. A ¾-in. pipe is also used for this section's crossarms. There are only five arms on a vertical conduit, and they too are spaced on 24-in. centers. And, instead of supporting the conduit rack by the hook arrangement used in the first section, this rack's vertical conduits are welded at their top end to 7-ft pieces of ⅜-in. angle irons that are supported from steel cross struts spaced 7 ft apart.

Special DC Breaker for Rolling Mills

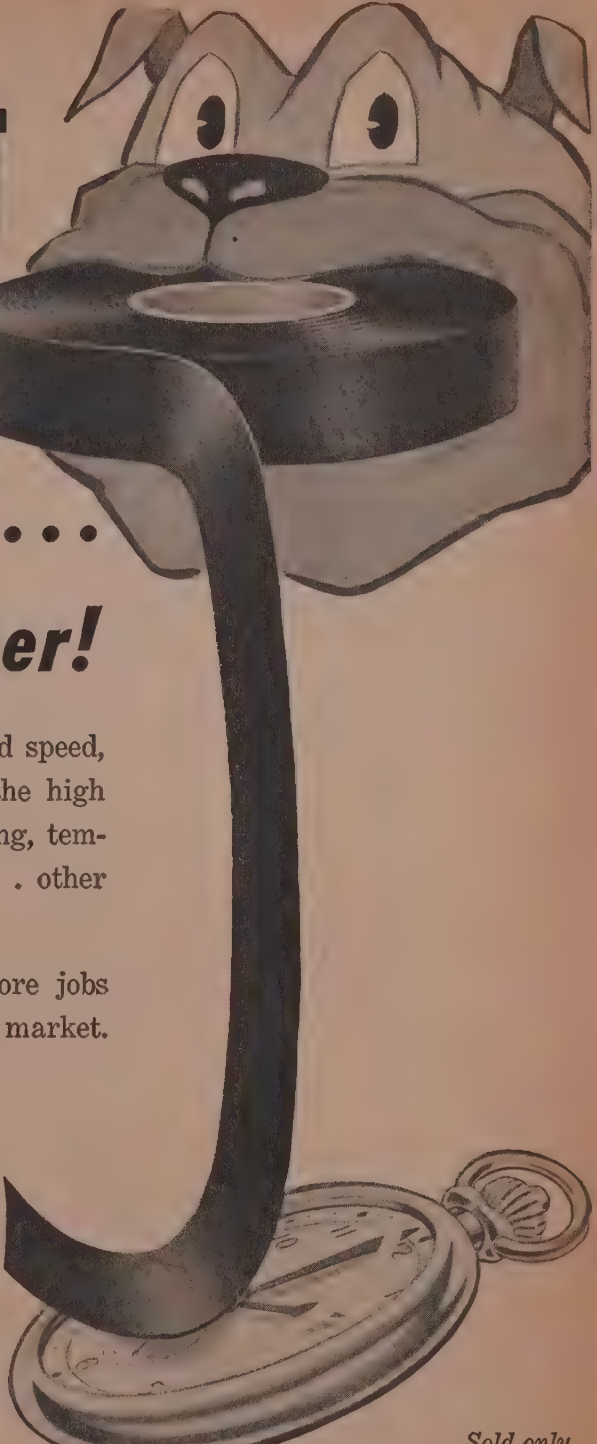
A high-speed, dc circuit breaker, which limits buildup of fault currents within 0.006 second, provides the fast action required for protection of the main drive motor and generator of a Sendzimir rolling mill at The Stanley Works, New Britain, Conn.

The breaker, a type FB current-limiting unit made by I-T-E Circuit Breaker Co., Philadelphia, was developed specifically for such applications, where high-speed protection of dc circuits is required.

The Sendzimir mill rolls both high and low carbon strip steel up to 1500 ft per min. In the event of a jam-up or "crash," the main drive motor could stall, causing a rapid rise in armature current. By limiting fault current before it can go beyond a safe level, the breaker eliminates any possibility of serious damage to the motor and generator.

Essentially, the mill consists of a set of driven rolls with a winding reel at each end carrying steel strip. The work rolls are driven by a 1750-hp, 450/850-rpm, direct-connected motor. Each of the two winding reels is driven by two motors, one rated at 300 hp, and the other at 600 hp, both 400/1200 rpm. An adjustable-voltage control sys-

Bull Dog®
Tape



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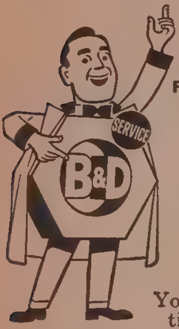

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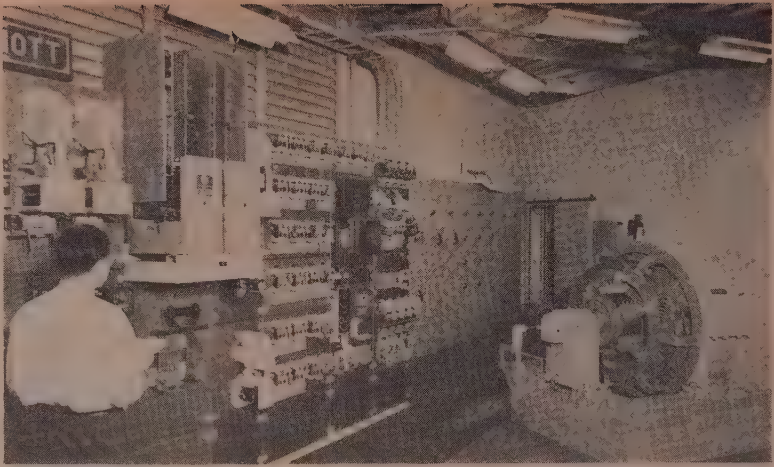
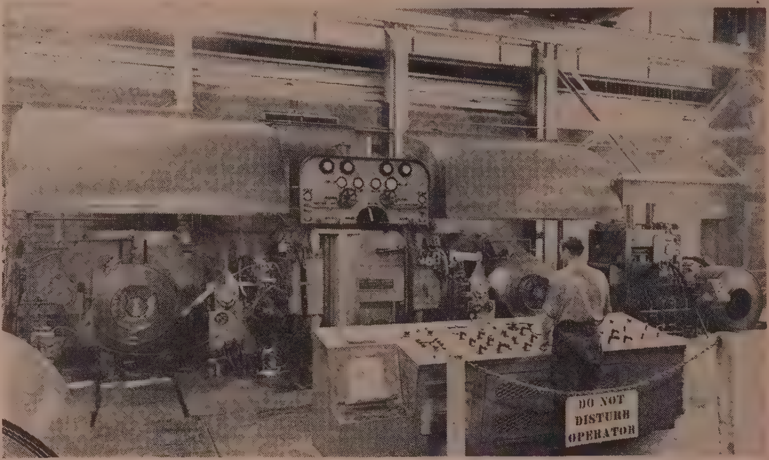


HIGH-SPEED, DC CIRCUIT BREAKER protects Sendzimir mill's main drive motor and generator from damage in the event of a jam by limiting fault current before it can exceed a safe level. The two-pole, type FB breaker has one pole calibrated for forward direction overcurrent tripping, and the other pole for reverse.



SENDZIMIR MILL at The Stanley Works, New Britain, Conn., rolls both high- and low-carbon strip steel to precision tolerances as fine as 0.0002 of an in. The strip, from coils weighing as much as 15,000 lb, runs through the reversing mill up to 1500 fpm. Electrical motors and generators are protected by a high-speed, current-limiting dc circuit breaker.

tem on the main drive provides variable speed control from low threading speed to any desired running speed up to 1500 fpm.

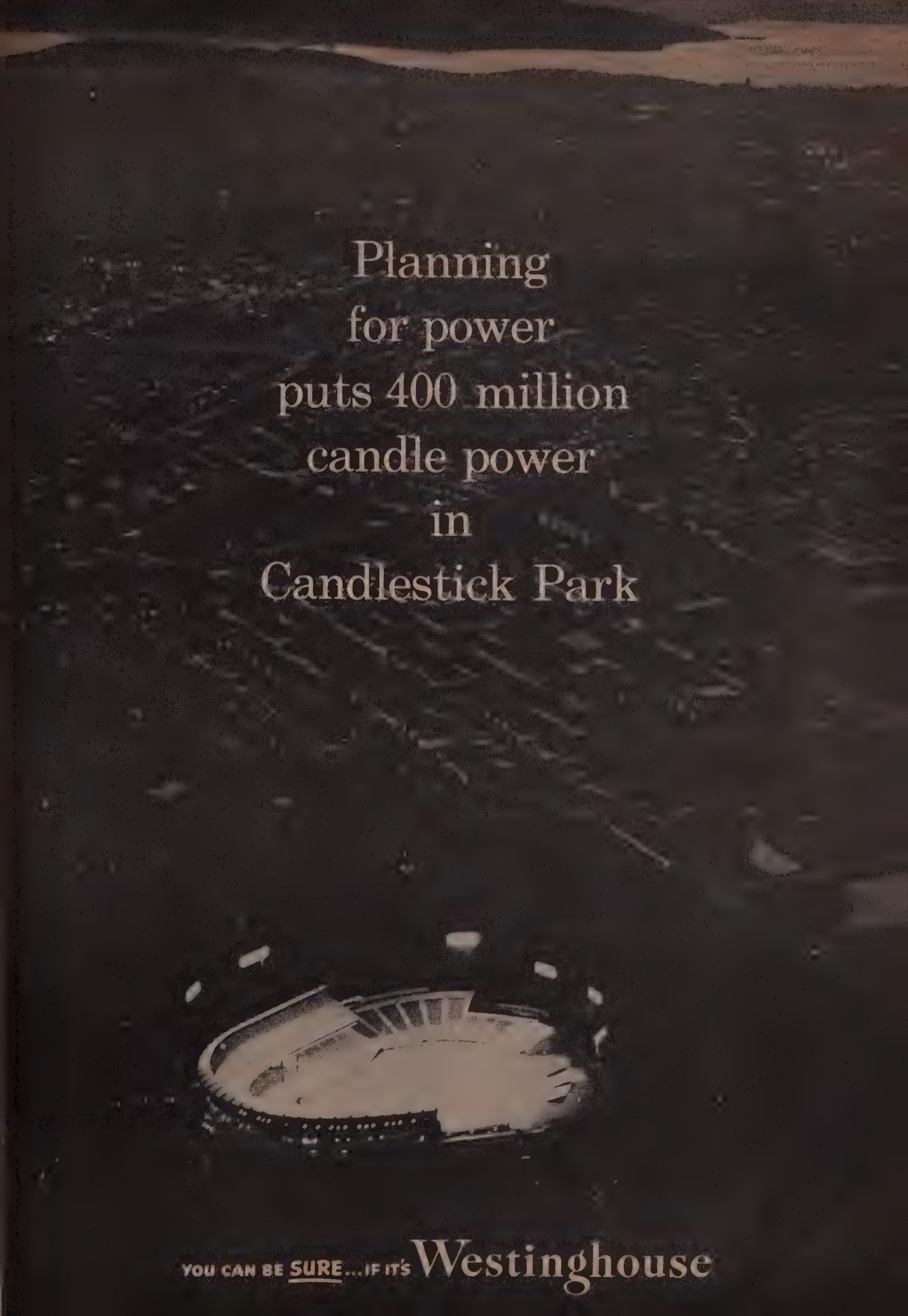
Voltage is supplied by a four-unit motor-generator set. And mounted coaxially with a 3000-hp, 720-rpm synchronous motor are three separately excited dc generators. Two of the generators are rated 750 kw at 720 rpm, and the third unit 1500 kw, 720 rpm.

Each 750-kw generator supplies power to the motors of one winding reel. The 1500-kw generator powers the motor of the work rolls. In the event of a "crash," the two-pole FB breaker will instantly disconnect the circuit between the main drive motor and its generator.

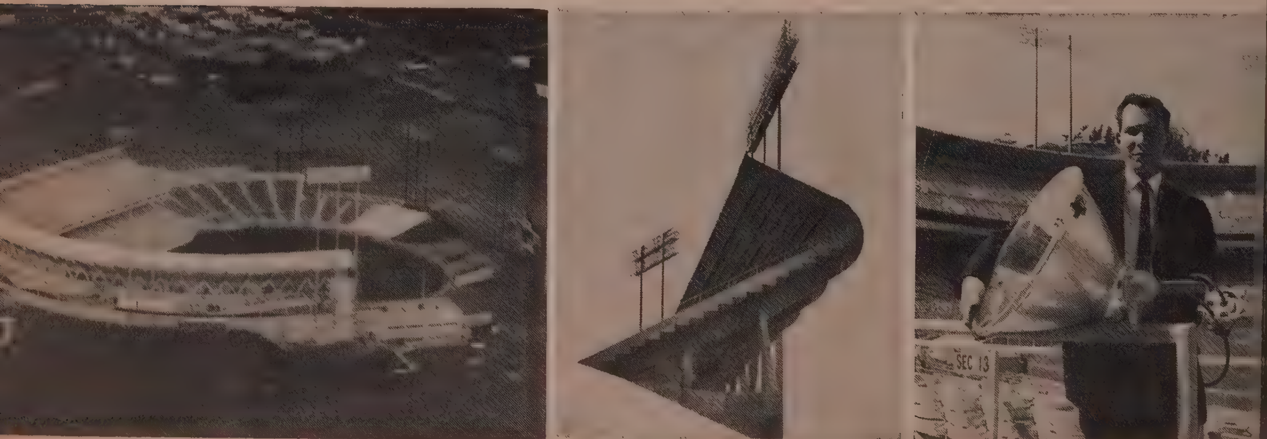
Being a reversing mill, strips are rolled alternately forward and backward. Because direction of the motors is changed by reversing the voltage of the generators, the two-pole FB breaker has one pole calibrated for forward overcurrent tripping and the other pole for reverse overcurrent.

At this mill steel can be cold-rolled to a tolerance of 0.0002 in. It incorporates automatic screw-down control and X-ray gauges with automatic recording and control units to insure uniform quality and extreme accuracy.

Successful operation of the high-precision mill depends upon reliability and continuity of operation of these driving units, which were supplied by the Elliott Company of N. Y. In operation for over a year, this million-dollar mill operates 24 hrs a day, six days a week.


Planning
for power
puts 400 million
candle power
in
Candlestick Park
YOU CAN BE SURE...IF IT'S Westinghouse

Detailed analysis of power requirements by a team of electrical experts produced a highly reliable, efficient distribution system that assures uninterrupted service throughout Candlestick Park. Checking system specifications: Spence Pors, Westinghouse Distributor Salesman; Electrical Contractor G. F. Brayer of Brayer Electric Company; C. L. Harney, General Contractor; L. E. Patton, Consulting Electrical Engineer; H. G. Dechene of Brayer Electric Company; and D. G. Hartman, Westinghouse Sales Engineer.



America's newest baseball arena, Candlestick Park, is Powered-Up for maximum nighttime "see-ability" and "playability" with 1147 Westinghouse Type VRC-20, 1500-watt floodlights mounted on eight towers, all approximately 200 feet high. A strikingly designed wind baffle tops the massive concrete stadium that blends well with the modern design of these lighting standards. The spun aluminum floodlight reflectors are mounted on swing-over brackets with automatic latch for maintenance ease. Under direction of Westinghouse Lighting Engineer Reed Hansen (photo right), all floodlights were spotted on the ground prior to erection of towers. This preplanning helped considerably in cutting installation cost.

Electrical team Powers-Up Giants' new stadium for adequate, failure-free operation

an Francisco's Giants batted a 3 to 1 victory to naugurate their bright new home in the West, andlestick Park—one of the nation's finest, best-ghted baseball arenas.

To boost "seeability" and "playability" at night, 147 1500-watt Westinghouse floodlights were intalled, to furnish 400 million candle power for one f the best lighted stadiums in America. All floodghts were spotted on the ground, which saved on nstallation costs. And operation of all stadium ghting was made extremely convenient. A central anel controls field, seating, main corridor and arking lot lighting. Thorough consideration of the ower requirements of other nighttime sports, like ootball, prompted provision for future expansion f the park's power system.

During the planning and erection of Candlestick Park, extensive consideration was given to its power requirements. The electrical contractor teamed up with the consulting electrical engineer, Westinghouse electrical distributor and engineers for close cooperation with the architect. Preplanning disclosed that eight Westinghouse power centers spaced around the stadium would provide the most economical, efficient method of distributing power for stadium lighting and other electrical equipment.

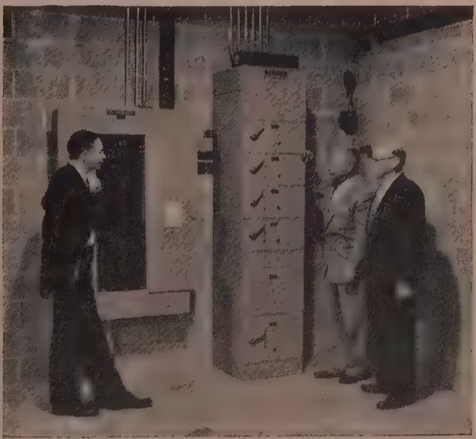
(cont.)

YOU CAN BE SURE...IF IT'S Westinghouse

TUNE IN WESTINGHOUSE-CBS TV-RADIO COVERAGE, PRESIDENTIAL CONVENTIONS, JULY 10-29

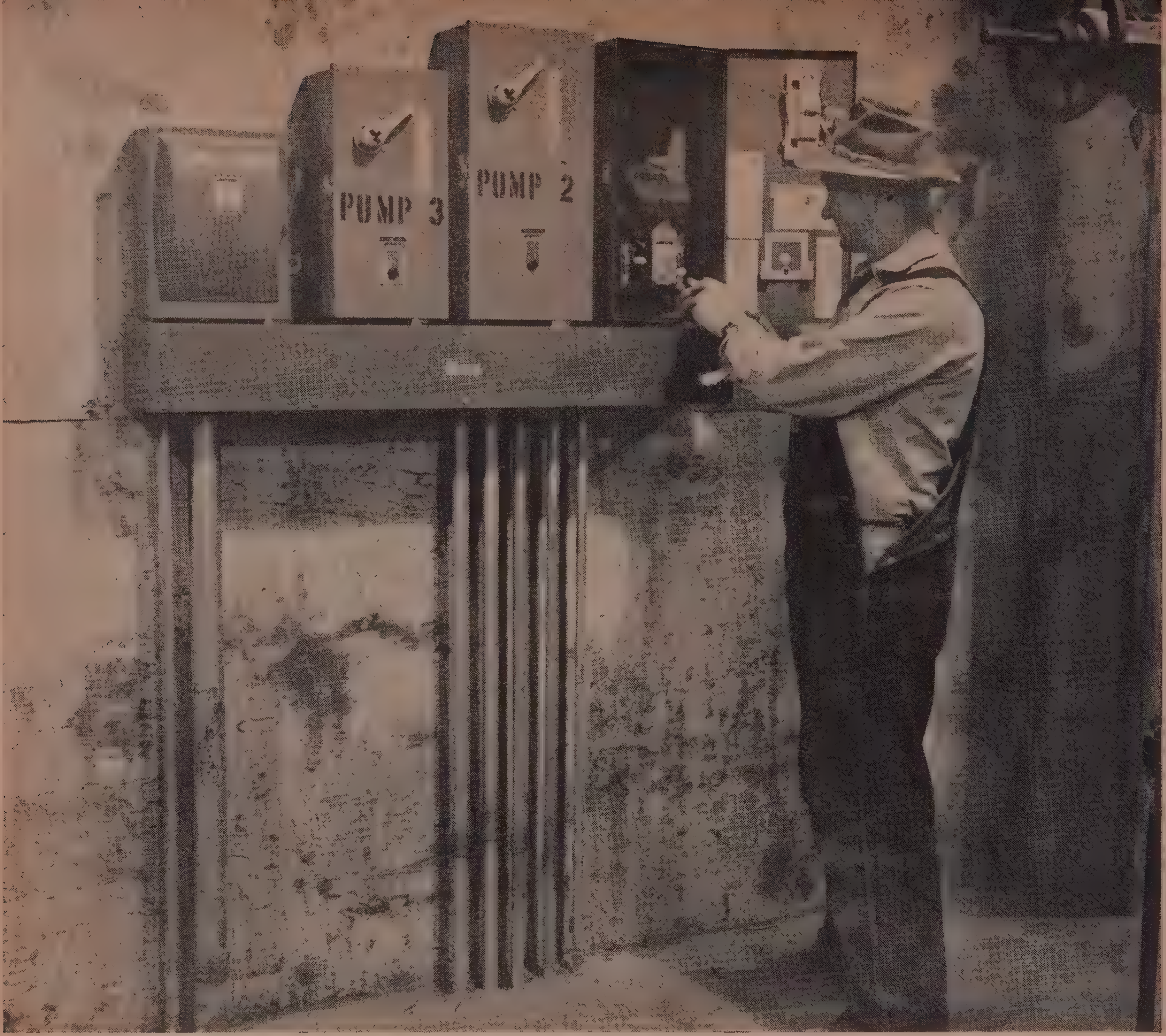
94144-3

Economical power distribution for Candlestick Park was achieved with eight Westinghouse unitized power centers ranging from 750 kva to 225 kva, all with provision for expansion when required. Each power center steps 12-kv primary power down to 120/208 volts to serve lights and electrical equipment. Inspecting AB and DB feeder breakers are: M. P. Buswell, Westinghouse Area Sales Manager; C. L. Harney and L. E. Patton.



Motor control and protection is afforded by the Westinghouse motor control center under examination by J. R. Miller, Westinghouse Sales Engineer; Spence Pors and G. F. Brayer. This control center groups all motor controls together in interchangeable, space-saving, easily installed modular units. Breakers in CDP distribution panelboard at left protect against faults in the power circuits of mechanical equipment area of new stadium.

A 45-kva Type DT-3 dry-type transformer steps 120/208-volt, three-phase power up to 480 volts for parking lot lighting. Compact and maintenance-free, these lightweight transformers can be placed in most any out-of-the-way, nonpremium space. Candlestick Park's transformer, inspected by L. E. Patton and J. R. Miller, is located in a lamp storage area behind one of the eight power centers.



Electrical team Powers-Up Giants *(cont.)*

Westinghouse products were chosen for Candlestick Park for their ability to provide dependable, uninterrupted service. For information about how Westinghouse electrical equipment can meet your needs and help you Build Business Electrically—contact your nearest Westinghouse distribution outlet. Or write, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

J-94144-4

Reliable auxiliary equipment is found throughout Candlestick Park. *Above,* the control line-up contains a CAF-322, 240-volt, 60-amp fused safety switch; Class 11-206, Size 1 combination Life-Line® motor starter; and two Class 11-206, Size 2 combination Life-Line motor starters on one of which E. R. Reynolds, Job Foreman for Brayer Electric, makes an adjustment, and *below* he checks a Westinghouse 3-hp, Frame 213 Life-Line "A" compressor motor. Its open dripproof frame provides plus protection with openings facing down. High starting and breakdown torques inherent in compressor design of the Life-Line "A" motors assure adequate air supply.

OWNER: San Francisco Stadium Inc., for City and County of San Francisco

ARCHITECT-ENGINEER: John S. Bolles, San Francisco
E. Elmore Hutchison, San Francisco

CONSULTING ELECTRICAL ENGINEER: Lyle E. Patton, San Francisco

GENERAL CONTRACTOR: Chas. L. Harney, Inc., San Francisco

ELECTRICAL CONTRACTOR: Brayer Electric Co., San Francisco

WESTINGHOUSE DISTRIBUTOR: Westinghouse Electric Supply Co., San Francisco

YOU CAN BE **SURE**...IF IT'S **Westinghouse**

TUNE IN WESTINGHOUSE-CBS TV-RADIO COVERAGE, PRESIDENTIAL CONVENTIONS, JULY 10-29

Shop Displays Help Generate Sales

Electrical component and accessories display in 100-ft showroom sparks counter sales at Electric Maintenance & Repair Co., Jackson, Mich.

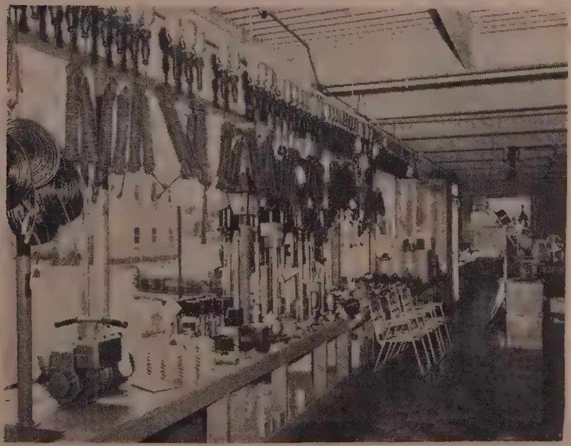
JACKSON HOME of Electric Maintenance & Repair Company. Showroom area faces main thoroughfare.

MERCHANDISING is an important adjunct to the overall business operation of the Electric Maintenance & Repair Company serving industrial and rural farm areas around Jackson, Mich. As an electrical maintenance organization, the firm is a distributor for nine major electrical equipment manufacturers and a dealer for a number of other companies. Its customer services include maintenance of a substantial inventory of motors, controls, spare parts; wiring supplies; contracting; and retail counter sales of component parts and equipment.

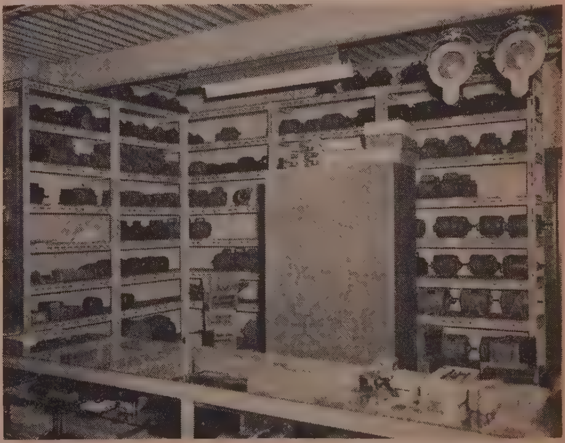
Shop owners Fred and "Gus" Bahlau feel that repair work leads to counter sales and vice versa. Operating experience bears this out. They also realize that effectively displayed equipment helps initiate and close sales which otherwise might be lost. There is definite psychological advantage in having a customer see and inspect equipment in which he is interested. And there is the plus value of impulse buying on the part of a browsing customer who might have passed up a purchase if he had not spotted the item in the shop.

With this philosophy as background, the Bahlau's set up an attractive 100-ft long showroom with a tasteful display of electrical equipment and accessories. The area extends a silent invitation to the customer to "come in, look around and pick out what you want, need or may need." Two counter men and a stock man stand ready to handle the business of this department.

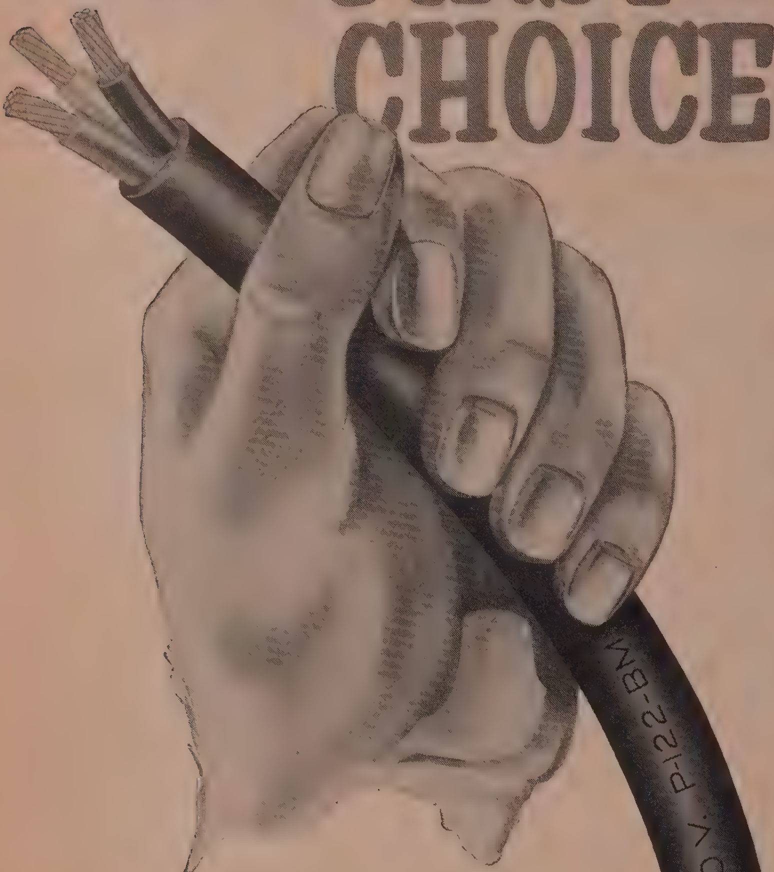
The long, uninterrupted show window facing the street has a sill-height display platform with storage space underneath. On the opposite side of the rectangular room are counter display cases and free-



WINDOW DISPLAY of electrical equipment includes such items as sump pumps, extension lights, motors, and portable generators. Note storage space under window platform.



MULTI-TIER slotted-angle framework forms motor-storage alcove. Glass case in foreground serves as counter and display cabinet.


ROYAL 14/3 TYPE SO 600 V. P-122-BM

ROYAL ELECTRIC

FIRST CHOICE

among men who know portable cord!

Yes, more electrical contractors and maintenance men specify Royal than any other portable cord in its class! Why? The reason is simple, but important to men with jobs that depend on the quality, safety and durability of the flexible cord they use: every foot of ROYAL cord and cable meets the high-performance standards you need on the job.

Your wholesaler stocks a complete range of Royal types and sizes — rubber, neoprene and plastic jacketed cords, power cables, thermostat cable, lamp and fixture wires, machine tool wires, and heavy-duty "POWR-KORD" extensions. All *made* right, *priced* right, *packaged* right — quick and easy to use!

Next time you order cords, specify ROYAL . . . preferred by electrical men everywhere!

ROYAL ELECTRIC . . . an associate of ITT

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND
In Canada:
Royal Electric Company (Quebec) Ltd.
Pointe-Claire, Quebec

PEG BOARD mounting of motor control items provides high degree of flexibility in display arrangement. Items can be quickly added or removed as required.

FRED A. BAHLAU, co-owner of EM&R, firmly believes counter sales are a natural supplement to a motor repair business.

OFFICE AREA has pine paneling, flush wall cabinets, and plenty of work space.

standing motor and equipment storage racks. To maintain a high degree of flexibility in shelf spacing and display arrangement, peg board and slotted angle framing are used to advantage. Motor stocks are stored on $\frac{5}{8}$-in. plywood shelves supported by multi-tiered slotted angle racks extending from floor to ceiling. Full lines of disconnect, magnetic, limit, and drum switches and pushbutton controls are attractively displayed on 8- and 4-ft peg boards.

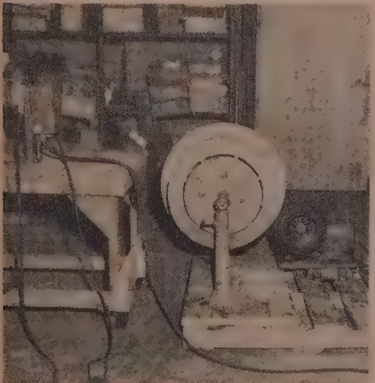
EM&R management is confident this showroom venture will pay off in more business and more satisfied customers. It's all part of a basic premise that if you make it easy for a customer to do business with you, both you and he will benefit therefrom. This philosophy of consideration also applies to internal organization where office employees work in quiet surroundings.

Motorized Dereeler For Lamination Stock

Motor repair shops generally possess a diversity of talent and ingenuity that permit them to boost the efficiency of their own operations and increase customer service. When an unusual customer request or shop problem arises, they invariably come up with a practical, timesaving answer. When time is especially pressing, or needed equipment is not readily available, they build their own to solve any immediate specific production problem.

This is normal procedure at the motor repair division of Barker-Fowler Electric Company in Lansing, Mich. A recent customer order involved the development and construction of a duplex induction heating unit to be used in the production of automobile brake drums. Among a variety of shop operations was the cutting of hundreds of different size transformer steel laminations on a power shear. To speed up the work, this phase of construction was put on a production-line basis.

A total of six coils of 0.014 in. silicone transformer steel (M-7 transformer iron with a C-10 coating) was ordered. Each coil was 11 in. wide and weighed 1,000 lb. Unit design called for ten different lamination lengths ranging from 3½ in. to 30 in. A mechanical counter actuated by the shear blade tallied the number of cuts in each size category. The main problem was to devise a continuous pay-out method that a single operator could synchronize with the power shear operation. Under the supervision of manager Mason V. Green, B-F mechanics developed a motorized



MOTORIZED DEREELER for heavy coils of lamination steel incorporates collapsible wood reel friction-driven by rubber-tired wheel on a gear-head motor. Note wood-pallet base for assembly; also foot-switch control. Movable "control table" at left is clamped to shear table.

NEW BULLET BEAUTY

FOR OUTDOOR DUTY!

Don't let the styling of STONCO's new "Award Series" fool you. These are **outdoor** bullets. Solid cast aluminum. Completely weatherproof. "Air-conditioned" for cooler, cleaner operation. The only truly decorative floodlights designed specifically for any outdoor application.

1 Epoxy-cured finishes stay factory-fresh through severest weather. Resist salt-spray, corrosives.
2 Degree-marked pre-aiming quadrant.
3 Deep-gripping serrated teeth for focus lock-in.
4 Full-circle vented ribs (pat. pend.) — pull a moving, cooling air-stream up through the fixture and out.
5 Big internal heat-dissipating fins.
6 STONCO "Cushion-Seal" — high-temperature live silicone-rubber weatherseal. Protects in any fixture position, even face-up.
7 Plenty of grip-space between lamp and shield.
8 Lifetime cast aluminum — with that solid heft indoor units just don't have.

A COMPLETE LINE FOR 75W-300W REFLECTOR LAMPS Single or cluster fixtures in 3 distinctive styles, wide range of finishes. For ceilings, walls, under eaves . . . all exteriors requiring a high-degree of architectural and color fidelity.

- The Award Series is now on display at your STONCO distributor. Look for it.
- Write today for Award Series catalog: Section A-3.
- See Sweet's Architectural file: 33a/ST.

STONCO Award Series

CLUSTER LIGHTS
POWER BEAMS
VAPORTIGHT
BOXES and FITTINGS
EMERGENCY PORTABLES

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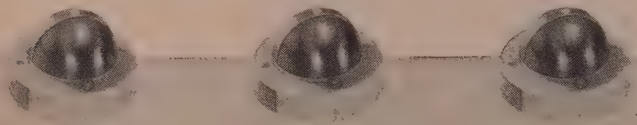
Fire detection is big business! Cash in now with Kidde equipment!

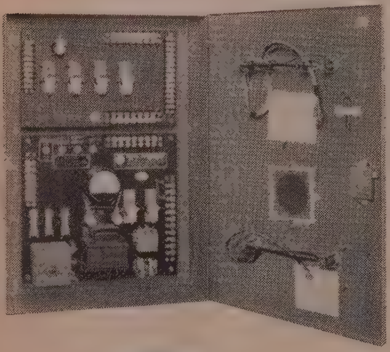
For years, schools, public buildings, businesses and homes have been waiting for an inexpensive, dependable fire detection system approved by U.L. and F.M. Now you can sell them this vital detection system at a reasonable price. When you sell a Kidde fire detection system and install it yourself, there are thousands of dollars in potential profits for you.

And, selling Kidde, you can be sure that you're selling quality. For more than 30 years, Kidde has been the leader in fire safety. It's a name you and your customers can trust!

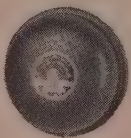
Find out more about Kidde fire detection components—and how you can use them to cash in on these most profitable markets! For more details, write Kidde today.



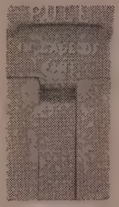
Kidde Fyrindex detectors. Self-resetting, fast-acting, easy to install. Fixed-temperature units each protect up to 225 sq. ft. Rate-of-temperature-rise models protect to 900 sq. ft. Combination rate-of-rise, fixed-temperature units each protect 2500 square feet. All U.L. and/or F.M. approved.



Control, rectifier, zone annunciator panels contained in one cabinet. Monitors up to ten zones. 12 or 24 v., dc.



Kidde weatherproof alarm bells — 6", 8", and 10" diameter. U.L.-approved.

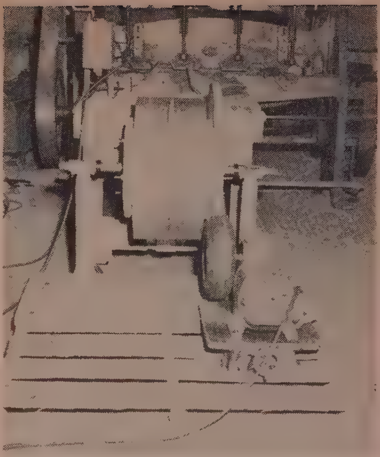


Manual alarm pull for one or more stations.

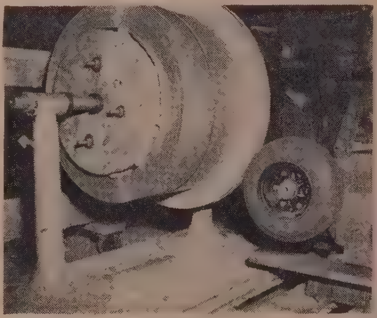
Kidde

Kidde Ultrasonic & Detection Alarms, Inc.
685 Brighton Road, Clifton, New Jersey

A Subsidiary of Walter Kidde & Company, Inc., Belleville 9, N. J.



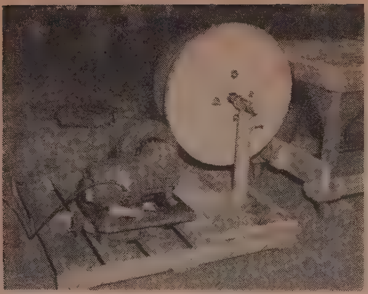
PERFECT ALIGNMENT of dereeler, control table and power shear assure controlled pay-out of steel and "square" cuts. Steel passes through guide-trough on way to shear. Note proximity of shear and dereeler control for one-man synchronized operation.



CLOSEUP OF REEL assembly showing smaller pressure disc on left and large driving disc on right. Adjustment of four through-bolts keeps coil from slipping on reel. Tire on gear-head motor rotates reel through frictional contact.

dereeler which fed the steel over a control bench to the front of the power shear.

To support the coiled steel, a slip-proof, friction-drive, wedge-type, collapsible wood reel was designed. The drive-disc on one side was made of two 30-in. diameter pieces of ¾-in plywood placed back-to-back This, in turn, supported a smalle disc (four pieces of ¾-in. plywood) with a series of tapered slides to fi inside the steel coil. The other hal of the reel consisted of a simila disc which was removable. All ree components rotated on a 1½-in. diameter steel shaft supported by tw reel pedestals. Internal wedge pressure on the coil was provided b adjustment on four through-bolt which tied the reel assembly together. Four set-screw collars o the reel shaft aligned and centere the coiled steel between pedestal Sleeve bearings on the reel shaf permitted free rotation. Reel pe

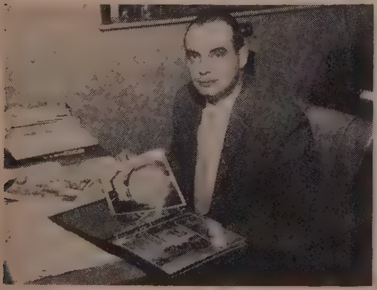


HAND-SCREW ADJUSTMENT on motor base assures maintenance of proper contact between tire and reel disc for effective pay-out of lamination steel.

estals were securely fastened to a built-up platform on a wood pallet base which also contained the drive-motor.

The friction-drive assembly consisted of a 12-in. diameter pneumatic-tire wheel (boat trailer type) keyed to the shaft of a ½-hp, 440-volt, 3-phase, gear-head motor with a shaft speed of 16 rpm. A hand-screw adjustable base on the motor permitted proper contact between tire and reel drive-disc. Motor and reel rotation were controlled through a footswitch, magnetic contactor and reversible drum switch combination.

With the control table in this position and securely clamped to the shear table, one mechanic could effectively synchronize shear operation with steel pay-out. He used his left hand to operate the shear control button, his right hand to channel the steel through a guide-trough on the table in front of him, and his foot to operate the dereeler. The trough, with its retaining sides slanting inward, assured "square" cuts; kept the steel flat as it passed under the shear blade; prevented hazardous buckling or snaking if a jam-up occurred or the end of the coil was reached.



PICTURES are an effective sales tool, believes R. B. Romanoff, president, Romanoff Electric Motor Service, Inc., now located in a 60,000-sq-ft, 3-story building in Toledo, Ohio. He uses both conventional and Polaroid cameras to photograph rebuilt and rewound equipment and special equipment assemblies.

2-way cure for motor repair headaches

Wagner Repair Kits are two-way remedies that take the headaches out of minor motor repair jobs.

1. YOU SPEED YOUR WORK—There's no time lost hunting for individual parts. You save time in filling out orders and billing. Every part you need comes in one package.

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Kit SA-2392 is for Wagner RA and KA motors in the 56, 57 or 65 frame sizes. Kit SA-2393 is for Wagner RB and RK motors in the same frame sizes. Order a supply of each now.

CARRY A STOCK OF WAGNER MOTORS . . .
BUILD NEW MOTOR SALES

Cash in when customers bring you motors that are not worth repairing . . . sell them Wagner Replacement Motors. Carry them in stock. You'll profit more, both in new motor sales and in time you can devote to better paying repair jobs.

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OVER 850 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS WR60-3
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the main characteristic of every Sorgel dry-type transformer is...

QUIET QUALITY

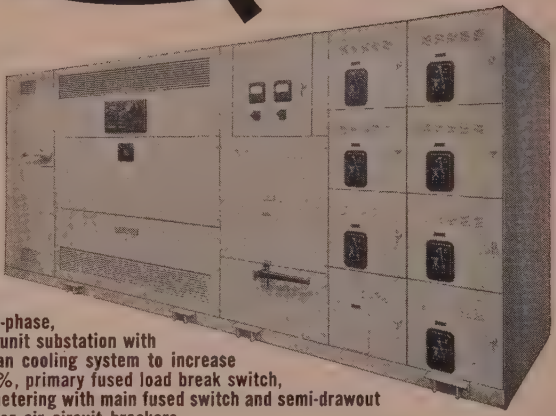
Still setting the industry's pace for lowest sound levels . . . Sorgel's New 1960 Line features additional reductions in size and weight!

A great many independent authorities agree that Sorgel Sound Rated Dry-Type Transformers have historically been the industry's Quiet Quality line. Biggest human reason why: Men with a desire for excellence make Quiet Quality a crusade at Sorgel. Significant results: (1) The industry's lowest sound level. (2) Unexcelled overload capacity. (3) Unequalled operating efficiency. (4) Long range economy. Proof: Certified tests and case history engineering data, furnished upon request, substantiate Sorgel's Quiet Quality performance. Customer benefits: Complete satisfaction and appreciation.

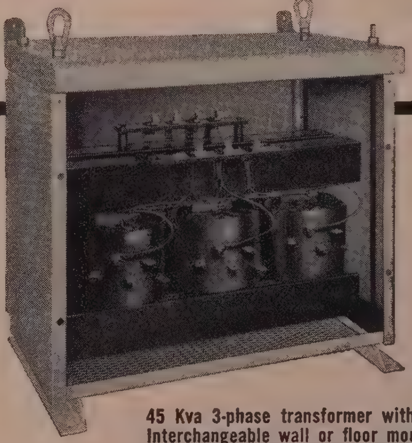
Sorgel also offers these proven advantages:

- **Lower Copper Loss** — *Coils are liberally designed for the most effective use of the latest developments in insulating materials, have large air ducts for low hot spot temperature and are vacuum-impregnated to provide a co-ordinated insulation system.*
- **Lower Core Loss** — *Cores are designed with the industry's lowest magnetic flux densities, resulting in low core loss and the lowest sound level. Entire unit is secured within a substantial frame. Large units are mounted on vibration dampers to minimize vibration transmission to adjacent areas.*
- **Quicker, Easier Installation**—*The enclosure is self-supporting and entrance can be made on sides, top, bottom, or back. Connecting is made easier by means of solderless connectors on terminal blocks in roomy connection compartments. Units up to 75 Kva single phase and 45 Kva 3 phase are furnished for interchangeable wall or floor mounting.*

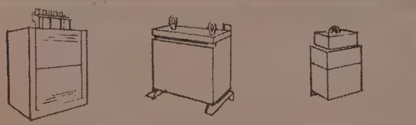
The same quiet SORGEL transformers are also incorporated in substations. Procurable with any type or make of switchgear, or from any electrical manufacturer. Contact Sorgel today for the Double "Q" in dry-type transformers . . . Quiet Quality.



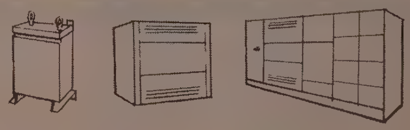
1500 Kva, 3-phase,
12,000 volt unit substation with automatic fan cooling system to increase capacity 33%, primary fused load break switch, secondary metering with main fused switch and semi-drawout fusible feeder air circuit breakers.



45 Kva 3-phase transformer with taps. Interchangeable wall or floor mounting. Front panel removed, showing interior.



SORGEL
SOUND-RATED DRY-TYPE
TRANSFORMERS



Complete Line for Every Purpose up to 10,000 Kva, up to 15,000 Volts,
Including Special Transformers and Saturable Reactors

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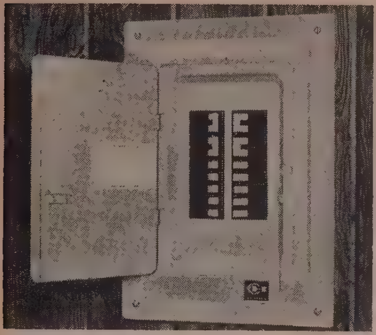
Product News



Circuit Breakers (1)

A new line of circuit breakers, called C-H Safetybreaker, blends with any decor. Electronically calibrated, the protective device provides positive circuit protection from direct shorts and build-up overloads via magnetic-thermal tripping action. The primary magnetic arrangement will trip under severe short circuit or overload conditions. Safetybreaker handles operate like a light switch with only two positions, on and off. They range in size from 2 to 42 circuits; 40- to 200-amp capacity; series, parallel and split-bus construction; single-phase 3-wire and 3-phase 4-wire. Publication ED-125 is available.

Cutler-Hammer, Inc., 315 *N.* 12*th St., Milwaukee, Wis.*

Ground Detector (2)

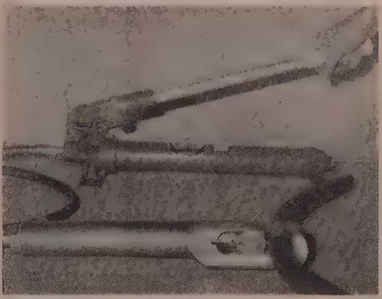
Ground detector alarm equipment consists of Type GDA resistor type ground detector and Type GDP indicator and alarm unit, and meets NEC and NFPA requirements for detecting circuit grounds in anesthetizing locations. Ground contact indicator will respond when any conductor of system becomes grounded through a resistance or a capacitive reactance of any value up to 60,000 ohms. Current through the ground indicator to ground under such conditions will not exceed 2 ma. A green signal lamp visible to personnel in the anesthetizing location remains lighted while system is isolated from ground, but an adjacent red signal lamp and an audible alarm signal are energized when indicator responds to leakage current. Signal may be silenced by a momentary pushbutton switch.

Crouse-Hinds Company, Syracuse 1, *N. Y.*

Transformers (3)

Redesign of a full line of distribution equipment transformers has been completed. Units, both conventional 300 to 2500 kva, and space-saving stacker-type units 112½ to 225 kva, are designed for use as integral distribution center transformers or as load center unit substation transformers to step down plant distribution voltage to utilization voltages. Both are available oil or Pyranol filled.

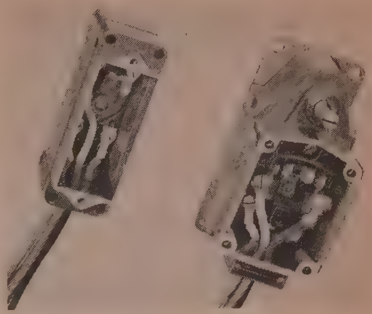
General Electric Co., Schenectady 5, *N. Y.*



Cutter and Crimper (4)

This cable cutter and crimper is a simple hydraulic ram in which oil pressure activates a hardened steel cutting blade. The forward edge of tool is constructed with a hook-like section which permits the operator to pry a cable away from flat surfaces, separating it from others in the group, and which then firmly seats the cable for the cutting process. The cutting blade moves forward under pressure, severing the cable with smooth, clean edges. Copper cables up to 1-in. accommodated. Crimping is equally simple. Operator replaces the cutting blade with two crimping dies. Then, with connector sleeve in place over the cable separation, the connector is seated in the aperture and pressure applied. The result is a tight coupling.

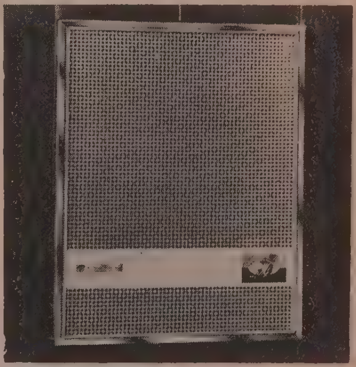
Welsbach Equipment Co., Inc., 1500 *Walnut St., Philadelphia* 2, *Pa.*



Limit Switches (5)

For applications where large quantities of oil and coolant are present, a line of potted limit switches which excludes all foreign materials and liquids has been developed. Switches are pre-wired, and conduit entrances are then sealed with epoxy resin. All Type AW and Type T limit switches can be furnished in the new design. Four No. 14 wires 5 ft long are furnished as standard parts. Special screws can be supplied to prevent access to inside the enclosure by unqualified persons.

Square D Company, 4041 *North Richards St., Milwaukee* 12, *Wis.*



Heaters (6)

A new line of built-in, fan-forced heaters designed for installation in "add-on rooms," basement family rooms, shops, or any place in the home where extra heat is needed. The built-in thermostat gives automatic room temperature control. Beige color grille and satin aluminum frame fits with any color scheme. Four models in new line have ratings ranging from 1500 to 4000 watts and develop from 5,120 to 13,650 Btu. All are rated 240 volts and are 20¾ in. high, 16 in. wide, and 4¾ in. deep.

Emerson Electric Mfg. Co., 8100 *Florissant Ave., St. Louis* 36, *Mo.*

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QUICK DEPENDABLE FASTENING

into concrete or steel

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Whenever plans call for fastening into concrete or steel, Ramset does the job in a split-second. Ramset powder-actuated fastening has proved far more efficient and economical than old-fashioned methods. With Ramset you're assured of quick, easy fastening, even under the toughest conditions . . . and every fastener is guaranteed!

Ramset offers an amazing variety of rugged Red Tip fasteners and dependable powder charges . . . just right for every application. This wide selection of fasteners and charges means you pay only for what you need . . . you get lowest in-place fastener cost with Ramset!

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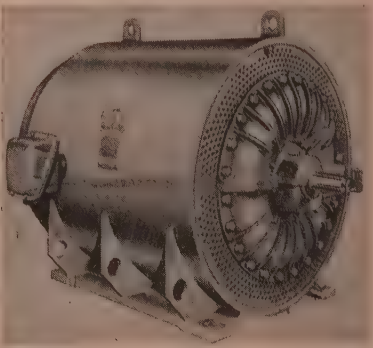
Transformers (7)

New distribution transformers rated at 25 kva, 2400 and 7200 volts, that operate at 65°C are called "Hi-Load-65." Despite higher operating temperature of units, same thermal overload capacity, 180% of nameplate on CSP units, as the 55°C transformer is offered. This is possible because of the combination of reduced loss ratio; new high-temperature insulating oil with a higher flash and boiling point, which is completely compatible with existing transformer insulating oil; and development of an improved Insuldur insulation system which permits higher operating temperatures without loss of life expectancy as compared to conventional transformers.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

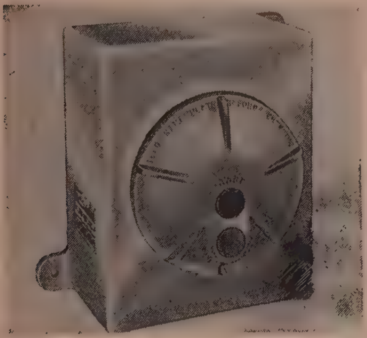


Motors (8)

Tube-cooled air-to-air heat exchanger motors, in sizes up to 2000 hp, are built in standard enclosed construction for use in non-hazardous locations and in explosion-proof construction with UL Class 1, Group D label for use in hazardous locations. Tube-cooled motors are designed to operate in unfavorable environmental conditions, providing protection against excessive moisture, oil vapor, chemicals, alkalies, coolant and air-borne dust, sand, dirt, and metallic particles.

Tube-cooled motors have application in industries such as petroleum, chemical, mining and primary metal processing, machine tool, pulp and paper. Other features include an effective cooling system, corrosion-resistant construction, capsule-type split-sleeve bearings, and pressure lubricating systems with oil level indicators. Bulletin No. 2400 is available.

Louis Allis Co., Milwaukee 1, Wis.



Housing (9)

An all-aluminum, explosion-proof manual motor starter housing is available. Housings in the GMMS series are equipped with mounting lugs for convenient installation, and a large screw-type cover for easy access. A set screw on cover maintains proper alignment of the control buttons with starter motor. They are front operated. New housings are suitable for custom hub arrangements.

Killark Electric Manufacturing Co., 3940 Easton Ave., St. Louis 13, Mo.

Utility Truck Body (10)

Seven new service-utility bodies designed specifically for light-duty trucks are offered in four conventional and three completely-enclosed models. Heavy-duty corrugated steel floors, full-length drip mouldings, completely - enclosed wheel housings and double panel, electrically welded steel compartment doors. All bodies offer 48½ in. of space between compartment sides. Conventional models are available in 79-, 82½-, 89- and 100-in. lengths. Enclosed models, with locking double rear doors, are offered in 82½-, 89- and 100-in. lengths. The 82½-in. bodies are designed for the International Travelette, which features a six-man cab. Catalog is available.

International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

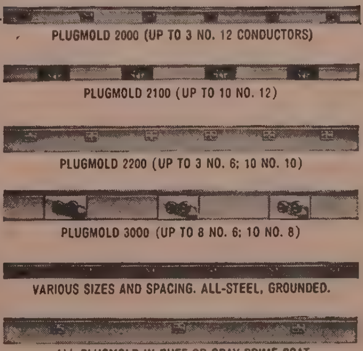
CAN YOU COUNT THE CONVENIENCE OUTLETS IN THIS LABORATORY?

Allied Control Co., Inc.

ONE *Free* WIREMOLD SCREWDRIVER to every contractor or engineer who sends in his guesstimate of the number of outlets in the absolutely unretouched photo at left. (Two screwdrivers for each **correct** answer! **Nobody** ever loses with Wiremold!) PLUS A CERTIFICATE THAT PROVES YOU ARE A GENUINE ELECTRICAL EAGLE-EYE!

YOU HAVE TO LOOK TO FIND THEM IN A PICTURE BUT THEY'RE ALWAYS SO HANDY IN PLUGMOLD

That's why contractors like PLUGMOLD. It's so easy to install; makes every job look so **good**. The customer is always right — always satisfied—with PLUGMOLD.



PLUGMOLD 2000 (UP TO 3 NO. 12 CONDUCTORS)

PLUGMOLD 2100 (UP TO 10 NO. 12)

PLUGMOLD 2200 (UP TO 3 NO. 6; 10 NO. 10)

PLUGMOLD 3000 (UP TO 8 NO. 6; 10 NO. 8)

VARIOUS SIZES AND SPACING. ALL-STEEL, GROUNDED.

ALL PLUGMOLD IN BUFF OR GRAY PRIME COAT

and remember: PLUGMOLD GIVES MORE OUTLETS FOR LESS MONEY

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steel... "Trouble Saver"® Rolling Scaffolds are erected from simple, easy-to-assemble parts. End frames, 2′, 3′ or 5′ wide, are joined by pivoted diagonal braces to form the basic unit. Additional frames are placed on top of the original basic unit by means of sprockets.

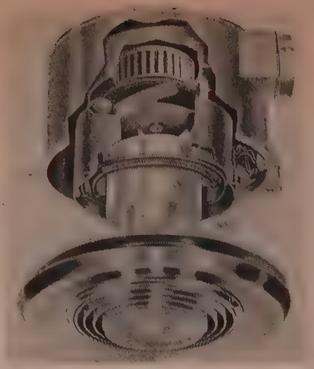
or aluminum... Sectional Scaffolds (illustrated) are erected from separate frames, braces, and stairways. Base dimensions are 4′6″ x 6′. Ladder Scaffolds, 29″ or 4′6″ wide, available in 6′, 8′ or 10′ spans with ladders 4′, 5′4″ and 6′7″ high. "Fold-A-Way" Scaffolds go up without acrobatics, flip-flops. Base unit 7′ high, sections 6′. Base —4′6″ x 6′.

When maintenance or repair goes above arm's reach, you can control costs with PS CO. Rolling Scaffolds . . . all bearing U.L. Label.

Write for Bulletin G-205RR

THE PATENT SCAFFOLDING CO., Inc.

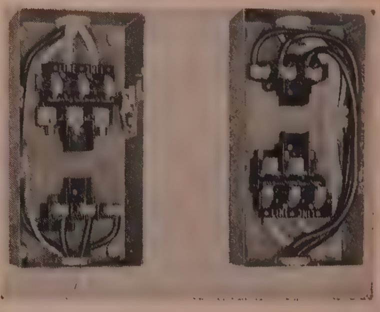
38-21 12th Street, Dept. ECM, Long Island City 1, New York
1550 Dayton St., Chicago 22 • Branches in all principal cities • 6931 Stanford Ave., Los Angeles 1



Ceiling Fixture (11)

A new Heat-a-Vent Lite, the all-in-one bathroom fixture that is a ceiling heater, circulating fan, an exhaust fan and light. Curve of cast aluminum grille and air diffuser blends into a new larger lens for maximum lighting. Unit extends 3½ in. from ceiling. Installation features a plug-in "B" unit, anodized aluminum ceiling ring to hide edges of rough plaster and new one piece grille with removable lens. Pre-wired switch has flexible leads. Fixture has two blades, propeller for circulating warm air and blower wheel to exhaust odors and steam. Exhaust louver automatically closes when heater is turned on. Enclosed armored heating element is thermal protected to prevent overheating.

NuTone, Inc., Cincinnati 27, *Ohio*



Safety Switches (12)

New red-handled safety switches rated 100 amps or more can be installed with line lugs at top or bottom. When line conductors enter switch from below, this feature eliminates the need to loop wires the full lengths of the enclosure, thereby reducing the amount of wire used to complete the installation. By means of a simple modification, switch mechanism and on-off nameplate are reversed. Enclosure itself is then inverted so that line lugs are at bottom, while outwardly the device maintains its conventional operating position.

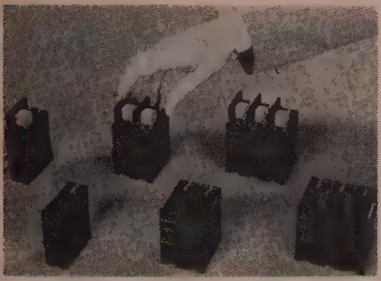
Up to 36 ft of 350 MCM can be saved on a twin conductor installation of a 600-amp, 3-pole G-E switch when the reversed mechanism feature is utilized. Bulletin CPD-74 is available.

General Electric Co., Circuit Protective Devices Dept., Plainville, Conn.

Baseboard Heaters (13)

Four new models of electric hot-water baseboard heaters feature a water system that is permanently weld-sealed against leakage so that water cannot escape or evaporate. Anti-freeze, supplied in liquid protects unit to 35° below zero when not in use. Heat limit control has been positively connected to water chamber that contains heating element, giving fail-proof control against over-heating.

International Oil Burner Co., 3800 Park Ave., St. Louis 10, Mo.



Circuit Breaker (14)

A new molded case circuit breaker for residential, commercial and light industrial applications. Design incorporates expanded handles on 2- and 3-pole models, running full width of breaker, which provide extra gripping area for easier manual operation. Other features are isolating air barriers, a new low instantaneous trip and load-side arc venting. Breaker is available in two basic models, EQ-P for plug-in connection and EQ-B for bolted connection. Breaker is built in ratings from 10 through 100 amps continuous-current at 120 and 240 volts ac. Models in 1- 2- and 3-pole are available. Breakers have quick-make and quick-break action for manual operation. Breaker handle operates on a trip-free principle to prevent holding contacts from staying closed on a fault. All EQ-P and EQ-B breakers have straight-in load connectors. All multi-pole models have common trip action to prevent single phasing.

I-T-E Circuit Breaker Company, Philadelphia, Pa.

Steel City SLOTTED ANGLE

with *"Mark and Measure"* lines

The specially designed portable Steel City Cutter cuts all three sizes of RIGHT ANGLE cleanly with one easy stroke.

Simplifies planning, cutting, erecting!

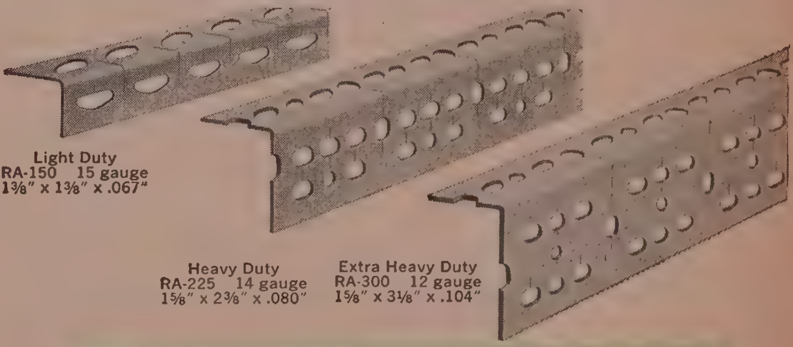
Steel City's RIGHT ANGLE*, in addition to a special mark on 3" centers, is line-marked every ¾" to provide greater refinement in cutting and to assure accuracy — faster — in assembly. The RIGHT ANGLE portable cutter features a fixed locating pin for cutting at 3" marks and an exclusive movable pin for cutting at ¾" marks.

The RIGHT ANGLE method of structural framing simplifies the building of structures . . . permits utilization of available space to the fullest extent.

*trade name

RIGHT ANGLE* IN 3 SIZES

A size, weight, and strength for Every Job



Special Features

- All 3 Sizes Interchangeable
- Ease of Assembly
- Rigid When Assembled
- Superior Galvanized Finish

Sold through wholesale distribution only!

Write for bulletin RA-1 or see our catalog in Sweet's files

STEEL CITY ELECTRIC COMPANY
A Subsidiary of American-Marietta Company
PITTSBURGH 33, PA.

200-AMPERE CAPACITY

IN THIS SIZE

Whether you're interested in service entrance equipment or a safety switch, you need look no farther than this newest Heinemann circuit breaker unit.

Far smaller than comparably-rated fused pull-outs, it carries a big 200-ampere load—consistently, without any allowances for ambient temperature. De-rating—or any form of temperature compensation—is simply unnecessary. The breaker is magnetically actuated; there's not a thermal element to be found. You can put this equipment next to heat lines, or inside a snow bank; it will always carry full-rated current, always trip as specified.

And it's easy to install. Wiring space is plentiful. So are knockouts (you can run-in conduit from any angle). Solderless screw-type connectors are another time-saver.

Rated at 120/240V AC, two- or three-wire service, this unit is available with indoor or raintight, tamperproof outdoor enclosures. Either way, it costs less than what you are used to paying for fused equipment with 200-ampere capacity after de-rating.

For full information send for Bulletin 1003

HEINEMANN ELECTRIC COMPANY

132 PLUM STREET TRENTON 2, N. J.

Connectors **(15)**

A complete line of Ark-trol electrical connectors for environment-resistant plugs and receptacles. Type RPE connectors are moisture-proof, shock-insulated, dust-tight, and corrosion-resistant. Type RPC circuit-breaking connectors have all the features of RPE plus ability to break circuits under full rated load. They operate in a temperature range of minus 80°F to plus 225°F, and withstand pressure of 300 psi internal.

Crouse-Hinds Company, Syracuse 1, N. Y.

Transformer **(16)**

New PMT Series offers pad-mounted transformers especially designed for residential underground distribution systems. Transformer installs above ground on a cement pad and is completely protected and self-contained in a cabinet. There are separate low and high voltage compartments in the cabinet. A single door allows access to low voltage compartment, with an insulating panel closing high voltage side for protection of personnel. Cabinets and primary lines can be installed whenever convenient, with transformer and secondary services installed later. An oil-immersed, load breaking, primary selector switch, located in high voltage compartment, allows sectionalizing at each PMT unit to isolate cable faults and maintain service during repairs. Cabinet accommodates all ratings from 15 through 100 kva.

Kuhlman Electric Co., Birmingham, Mich.

Fault Detector (17)

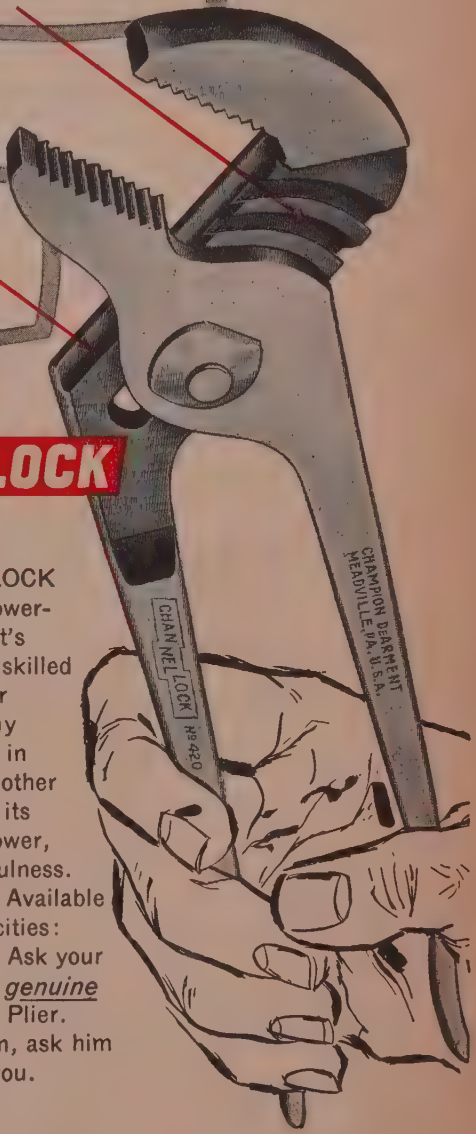
New 3-phase fault detector indicates faults in any 3-phase power system and instantly provides warning by flashing lights and sounding a warning horn. This completely transistorized device detects even minute leakages from any phase to ground. Unit is compactly designed, requiring 11½-in. by 14½-in. wall space for mounting. It may be quickly and easily installed by any maintenance man with regular tools.

General Kinetics Corp., 3151 Kenwood Ave., Burbank, Calif.

Pipe Threader (18)

New Sioux portable power pipe threader threads ½-in. to 4-in. pipe on the job or in the shop. Unit is powered by a ¾ hp motor which drives at 530 rpm at stem reduced to 26 rpm tool output. Housing and motor mounts are of "Tuff Amaloy," a ductile, aluminum alloy. It will thread bolts. With an auger it will dig holes.

Albertson & Company, Inc., Sioux City, Iowa.


CHAN NEL LOCK No 420
CHAMPION DEARMENT MEADVILLE, PA. U.S.A.

only **ONE** plier gives you **BOTH**

THESE POWER-GRIP FEATURES

Machined, Undercut Channels. Smooth working, can't slip under any load!

Reinforcing flange for added strength where you need it!

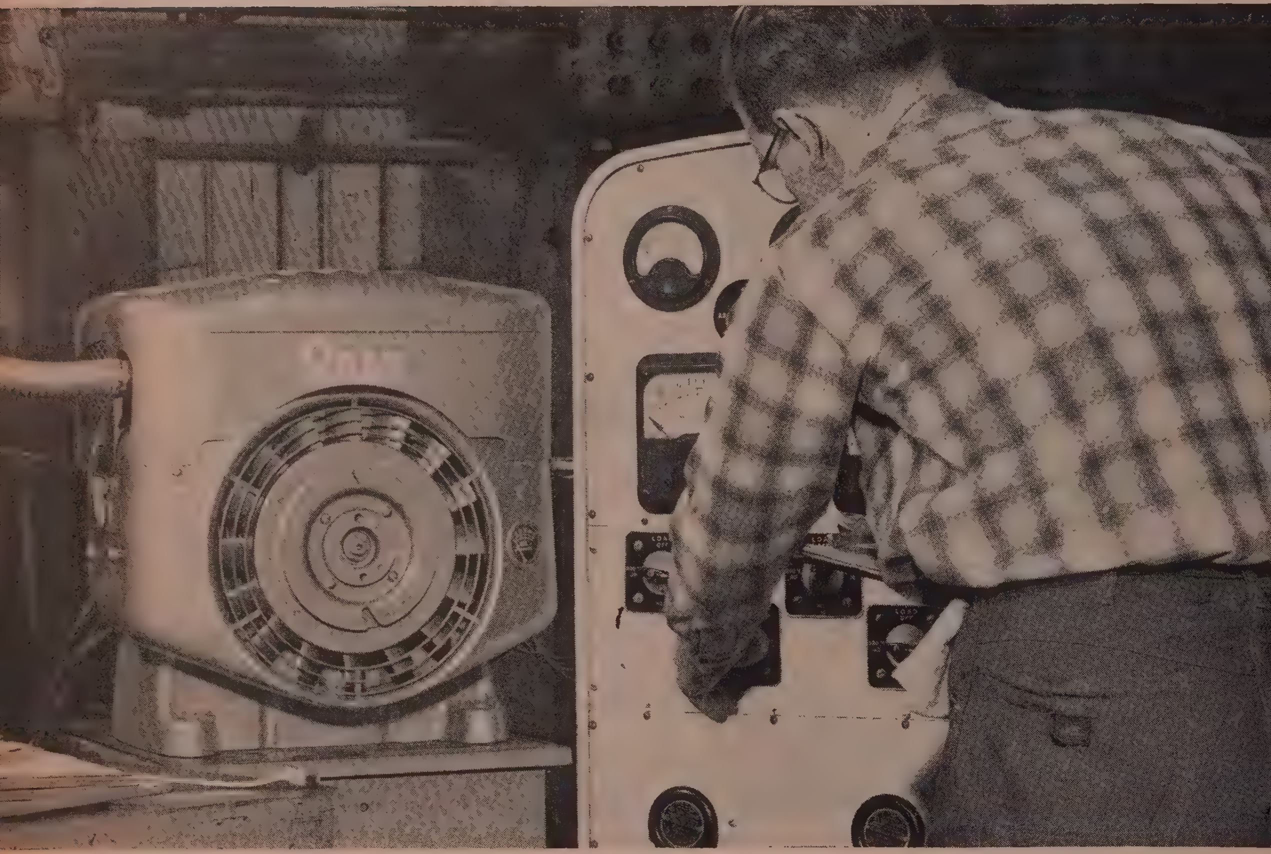
CHAN NEL LOCK®

Only CHANNELLOCK gives you these power-grip features. That's why thousands of skilled mechanics—year in, year out—buy CHANNELLOCK in preference to any other plier. They prefer its terrific gripping power, its all 'round usefulness. And you will, too! Available in three jaw capacities: ⅞", 1½" and 2". Ask your tool supplier for a *genuine* CHANNELLOCK Plier. If he's out of them, ask him to order one for you.

Write for Catalog of Complete Line of Pliers

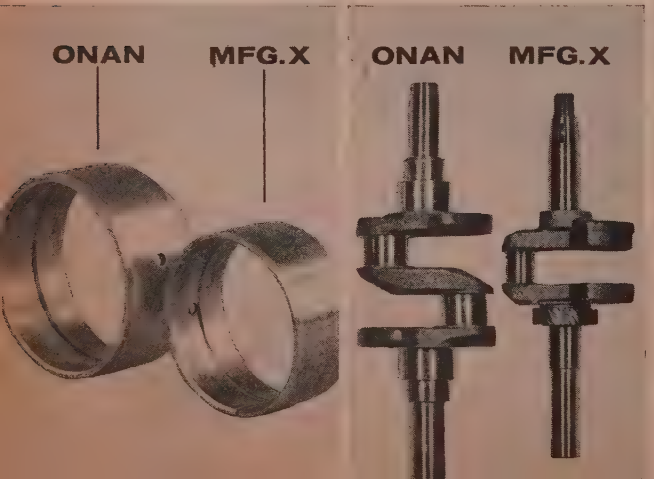
CHAMPION DeARMENT TOOL COMPANY
MEADVILLE 6, PENNSYLVANIA

Onan Electri
full power afte

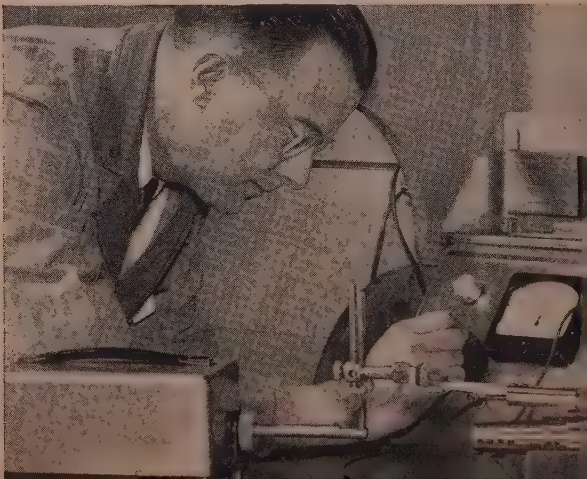


Typical Onan torture test—tougher by far than normal usage—proves Onan's ability to deliver on any job.

Generous design assures longer life—Husky Onan has double the bearing area of many equivalent rated engines . . . plus larger, stronger crankshaft to minimize breakdown and to give you longer, trouble-free service between overhauls.



Exacting standards govern manufacture—Years of specialized experience and extensive testing facilities control the quality of Onan Power Plants. Over 1000 different types and sizes of plants are produced by this same, careful method at Onan.



Plant still delivers 12,197 hour test run!

Run equivalent of 487,888 miles... killed and started... tortured, tested, retested... Onan Test Plant #1068 still delivered full-rated power

A grueling endurance test that lasted one year, nine months and 12 days could not stop Onan Test Plant #1068. Development engineers used this production-built unit as a testing laboratory. And after it was all over, it still generated the full rated power promised on the nameplate. Proof that Onan's exacting standards and production testing give you a power plant with long, dependable service built in.

Over 1,700 other endurance tests have been run by Onan development engineers. Here's where every design feature and part had to prove itself before it could become a part of the Onan you buy. In addition, every type and size Onan Plant is tested under all operating conditions which affect its performance.

Hours of running in and testing under load are given every Onan before it is shipped. An independent testing laboratory retests Onan-tested Plants and certifies Onan testing methods—double assurance that every Onan will deliver its full nameplate rating. Only then does an Onan qualify for its Performance Certified Guarantee.

You buy *proven* performance when you buy an Onan Plant. See your Onan representative. You'll find his name in the telephone classified section in every major city, or write direct.

ONLY ONAN GIVES YOU THIS CERTIFICATION

PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.

D. W. ONAN & SONS INC.
Minneapolis 14, Minnesota

Onan®

World's
Leading Builder
of Electric
Power Plants

D. W. ONAN & SONS INC., 2594 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINN.

BRONCO
Certified 66 NEOPRENE
PORTABLE ELECTRICAL CORD AND CABLE
has the HIGHEST NEOPRENE content in the industry

The protecting outer jacket on Bronco 66 Certified contains 67.32% Neoprene—highest in the industry! This is why your Bronco 66 cables last longer, have greater resistance to oil, ozone, sunlight, heat, flame, chemicals, and abrasion.

BRONCO TAKES THE GUESSWORK OUT OF CABLE BUYING

How do you know your type SO cord or type W, G & Control cable is the best that can be had?

Look For These Two Symbols of Certainty:

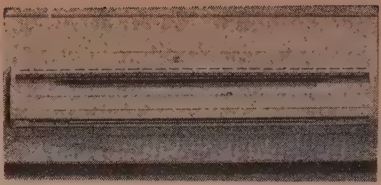
1. Branding—"Bronco 66 Certified—67.32% Neoprene" is molded* into the jacket at two-foot intervals.
2. Each carton and reel carries a registered certification as to jacket contents signed by a professional engineer. When you find these guideposts, then you will know that you have the best.

*U.S. PATENT #2867001

"We certify that the jacket of all cord or cable branded "Bronco 66 Neoprene Certified" contains not less than 67.32% of new Neoprene.

Western Insulated Wire Co
Registered Professional Engineer

WESTERN INSULATED WIRE CO.
LOS ANGELES 58, CALIFORNIA



Electric Heaters **(19)**

An all-new line of electric baseboard heaters, 500-, 750- and 1,000-watt densities are identically styled into 42-in. lengths to give a choice of 143, 214 or 286 watts per lineal foot for any room condition. Each heater has a thermal cutout that automatically cuts current should the unit overheat. Continuous cycles of automatic overheating and shutting off are avoided by a reset button which must be pushed to put the heater back into operation. Low surface temperatures have been retained in the new models—1,000 unit has a maximum of 140°F; 750-watt unit, 125°F; 500-watt unit, 102°F.

Meier Electric Company, 3525 East Washington St., Indianapolis 7, Ind.

Grounding Receptacles **(20)**

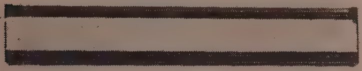
A new duplex, safety-grounding receptacle called "Twinsafe" protects both children and adults from dangerous electrical shock. First, it shunts current harmlessly away from metallic objects inserted in the slots by children or careless adults. Second, it has a U-shaped slot for grounding power tools and appliances equipped with plugs having U-shaped grounding blade. The only time that current can flow out through the slots is when both blades of proper plug-in cap are firmly in place in receptacle.

Harvey Hubbell, Inc., Bridgeport, Conn.

Marker Lights **(21)**

A new line of flush marker lights for airport runways, designed to combine safety with convenience. Lights extend 1 in., at their highest point, above the ground, and are available in three styles. Type FMU gives a single light beam from the approach direction only. Type FMB provides two beams of light, and is used on runway edges or wide intersections. Type FMT provides blue light in all directions, and is used along the sides or center-line of a taxiway. New marker lights are so designed that planes may land on or run over them at high speeds without damaging them, and snow removable equipment may also pass over the lights without breaking them.

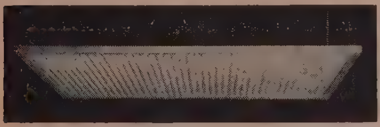
Crouse-Hinds Company, Syracuse 1, N. Y.



Electric Heat **(22)**

A full line of home electric heating units specially designed to meet the needs of specific areas of a home. The full line consists of baseboard units, radiant wall insert heater, forced air wall insert heaters, radiant cable, and portable heaters. Baseboard units may be recessed directly into wall. They measure 7½ in. high and 2½ in. deep. They are provided in two lengths; 48-in. section supplies 2972 Btu/hr at 900 watts and 32-in. section supplies 2048 Btu/hr at 600 watts. Also available are corner sections for making inside or outside turns and a receptacle section.

Fasco Industries, Inc., Rochester 2, N. Y.



Lighting Unit **(23)**

A new light-diffusing unit called "Island of Light," is complete with hangers and aluminum frame, and features the Diffusa-Lite Vinylux plastic panel with curved matte surface. Convex and concave surface of Diffusa-Lite panel is for use in home, commercial and industrial installations, and is adaptable to all types of architecture. Vertical panels which mount from frame and enclose lighting area to ceiling, are available. Panels are available in eight standard sizes from 3 by 4 ft to 6 by 9 ft dimensions. The Vinylux plastic may also be purchased separately in rolls in widths of 18, 24 and 36 in.

Diffusa-Lite Company, Conshohocken, Pa.

Built-in, Pre-loaded Shock Absorber In Boom
Cushions the Shock But Doesn't Absorb the Power!

THE DAVIS T-66

IS DESIGNED FOR
9 OUT OF 10
TRENCHING
JOBS

The new self-propelled Davis T-66 is designed and produced to handle 9 out of 10 trenching jobs after an exhaustive survey to users revealed what they wanted.

TRENCHES...AND BACKFILLS!

The Davis T-66 is both a trencher and a backfill machine. For trenching it features positive traction, hydraulic variable speed drive, accurate speed control, hydraulic operated boom, and convenient—virtually effortless—operation. It digs 3″ to 4″ wide to 66″ deep; or 12″ wide, 30″ deep, and at varying widths and depths in between. Only **two tooth combinations handle all digging widths.** Trenching speed is from 1-ft. to 12-ft. per minute depending upon soil conditions. The low-cost angle backfill blade attaches to the boom and is hydraulically controlled. The T-66 has two-speed drive with instant forward or reverse, powered steering, independent left and right positive clutches and disc steering brakes for maneuverability in backfilling operations. Compact and only 37″ wide, every one of its 1350 lbs. is packed with performance. Quality is built in every part. Still, it is priced less than you would expect. ASK ABOUT ITS 90-DAY UNCONDITIONAL GUARANTEE.

THE DAVIS PUP

digs by itself where others won't because it is self-propelled by a positive 6-speed winch drive. Digs 2″ to 3″ wide to 36″ deep or 4″ wide, 18″ deep.

THE DAVIS HUSTLER

Utility Trailer designed to carry the T-66 and many other items. 2000 lb. capacity, 48″ x 84″ deck. Has low center of gravity and load equalization regardless of load distribution.

SEND FOR FULLY ILLUSTRATED LITERATURE THAT TELLS HOW THE DAVIS T-66 PAYS OFF FOR YOU in 33 WAYS!

DAVIS MFG. INC.
1504 South McLean Blvd., Wichita 13, Kansas

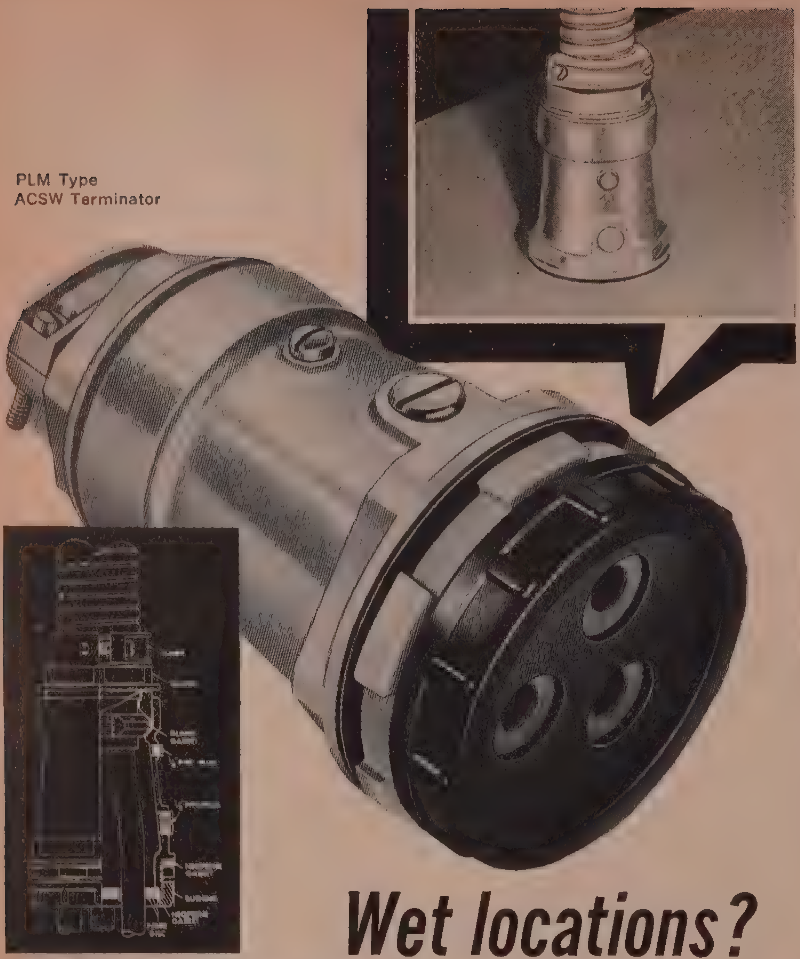
Please send me literature and name of my distributor for the Davis T-66____ Davis Pup____
Davis Hustler Utility Trailer____

NAME____

ADDRESS____

TOWN____ STATE____

T6-60-4


PLM Type
ACSW Terminator

Wet locations?

There's a PLM fitting to fit the job!

Terminating armored cable where a watertight cable entrance seal is needed? There's a PLM terminating fitting designed to fit the job—as there is to fit almost any other indoor or outdoor mounting requirement! The Type ACSW Terminator shown provides a compound-filled, watertight entrance seal in any position for jacketed armored cable. Variations available for non-jacketed. Other types meet needs for flange mounting on pothead bases or switchgear, or for angular, bracket or other special mounting.

PLM Terminating Fittings and Splicing Kits can speed up and simplify any cable installation or repair. Supplied for use with interlocked armored cable, non-metallic jacketed cable and lead-covered cable. PLM 52-page catalog 301 contain full description and prices. Write for copy on your letterhead.

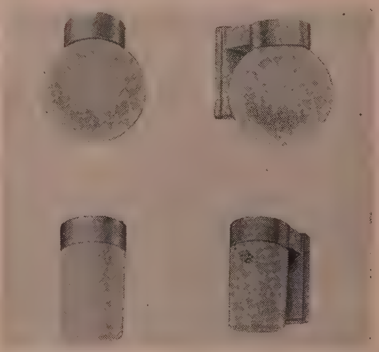
PLM Products, Inc.
TERMINATING AND SPLICING ACCESSORIES

3875 WEST 150th STREET • CLEVELAND 11, OHIO

Wire Puller **(24)**

A portable, hand-operated wire puller, called Porta-Puller, gives one man sufficient pull to 200-ft run through exposed or concealed conduit up to 2-in. dia. Unit is 40 in. overall and weighs 25 lb. Device finds added usage as a portable winch to hoist motors, fixtures, panels, conduit, etc.

Fairfield Industries, W. Passaic Ave., Caldwell, N. J.



Brackets **(25)**

Aluminum brackets for lighting fixtures are available in opal spheres and opal cylinders for ceiling or wall mounting. Brackets are die-cast, designed for indoor or outdoor use. All units are furnished with heat-resistant, water-tight neoprene gaskets. Globes for both types of units are in white opal glass. Spheres for ceiling and wall are one light, 150 watts. Cylinders for ceiling and wall are one light, 100 watts.

Halo Lighting Products, Inc., 4201 West Grand Ave., Chicago 51, Ill.

Fuse **(26)**

Buss low-peak fuses are capable of safely interrupting fault currents up to 200,000 amps, limiting let-thru current to low values and holding 500% load for minimum of ten seconds. Circuits can be fused close to their normal current load, and motor-starting currents or other harmless overloads will not cause the fuse to blow. On heavy fault currents, the fuse opens so rapidly the fault current cannot build up to a damaging peak. Electrical systems can now be designed so that starting with main fuse and dropping down to a 15-amp size, the protective devices at any point throughout the whole system will be capable of safely interrupting a fault current of 200,000 amps rms symmetrical. Fuses fit standard switches and panelboards. Available from 15 to 600 amps in both 250- and 600-volt ranges. Applications for this fuse include providing individual burnout protection to motors, solenoids or transformers as well as giving overload and short-circuit protection to circuit conductors.

Bussmann Mfg. Div., McGraw-Edison Co., University at Jefferson, St. Louis 7, Mo.

Utility Bodies **(27)**

A new series of job-planned utility bodies, called the 964 Series, are for the 1960 Chevrolet and GMC $\frac{3}{4}$-ton chassis. Front storage compartments have been increased in length and lowered. Bodies measure 96 in. in overall length to conform with increased cab-to-axle dimensions of these makes. Newly-designed body provides a lower center of gravity. There are adjustable and removable dividers and removable shelves in the weather-tight storage compartments.

Reading Body Works, Inc., Reading, Pa.

Exit Signs **(28)**

"Wafer Thin" 50 line is a compact code-regulated exit sign. It features aluminum construction with precision-stenciled face or glass inscription panels, 2-circuit wiring for either incandescent or fluorescent lamps, for 120- or 277-volt systems, and integral downlight, providing illumination of doorway in event of an emergency. Designer-styled for surface, wall, ceiling, pendant, extending bracket or recessed mounting, with satin aluminum finish and baked-on, clear lacquer protective coating.

McPhilben Lighting, Inc., 1329 Willoughby Ave., Brooklyn 37, N. Y.

WATCH FOR THE LADY IN WHITE
She's presenting big news next month about an exclusive new development in conduit!
S M T W T F S
1 2 3 4
5 6 7 8 9 10 11
12 13 14 15 16 17 18
9 20 21 22 23 24 25
6 27 28 29 30

Meeting Your Rigid Specifications...

#5031

U-GROUND

A complete line of 3-wire grounding devices — caps and receptacles.

LEVITON

SPECIFICATION (5000) GRADE

Look for a LEVITON 5000 number on the devices you specify. It proves that you are getting a LEVITON Specification Grade device—your assurance of top quality and dependability.

#5521

QUIET SWITCHES

A full line of 15 A and Heavy Duty 20 A—AC Quiet Switches.

#5101

#5112

LEV-O-LOCK

A full line of 2, 3, 4-wire devices in 10, 20, 30 amp. ratings . . . for dependable connections. (Push-turn-it's Lev-O-Locked!)

your best jobs are done with . . .

LEVITON MANUFACTURING COMPANY, INC.

Brooklyn 22, N. Y.

LEVITON

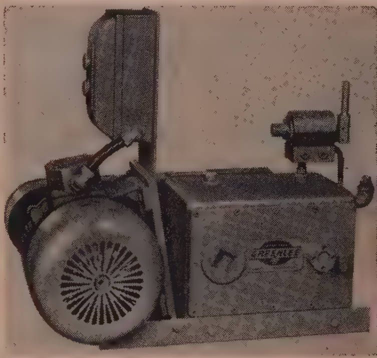
Chicago • Los Angeles • Leviton (Canada) Limited, Montreal

For your wire needs, contact our subsidiary AMERICAN INSULATED WIRE CORP.

Contactor (29)

A new 600-amp ac contactor, Type GP, for ac electric circuits. Contactor has an ac operating magnet and is insulated for a maximum of 600 volts. Designed for continuous duty, the ac coils operate the contactor at 85% to 110% of rated coil voltage. Unit can be mounted on steel and is available in 2- or 3-pole, front- or rear-connected assemblies, with or without arc quenchers. A permanent air gap is built into new structure to provide sufficient reluctance in magnetic path to insure a positive dropout on de-energization.

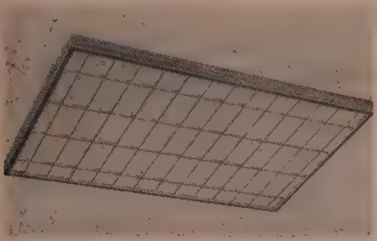
Westinghouse Electric Corp., P. O. Box 2099, *Pittsburgh* 30, *Pa.*



Power Pumps (30)

Two new high-pressure power pumps, No. 797E-TA and No. 797VE-TA are designed specifically to speed operation on a wide variety of hydraulically activated equipment. No. 797E-TA features radial-type pump with two diametrically opposed pistons driven by a drive shaft. A 4-way spool-type control valve, mounted on top of pump unit, controls high-pressure advance of ram and low-pressure return. Valve control handle is spring centered and has three positions: advance, neutral, and return. Neutral position holds ram pressure. No. 797VE-TA is identical to No. 797E-TA but includes an auxiliary low-pressure pump mounted on top of pump housing. Both have pump and power unit mounted on an angle iron base.

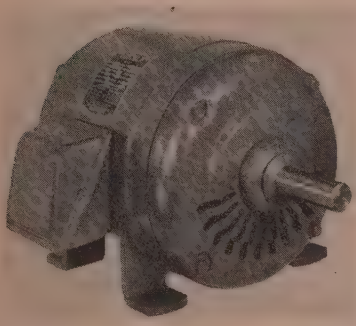
Greenlee Tool Co., Rockford, Ill.



Ceiling Fixture **(31)**

A new fluorescent ceiling fixture, called "Corona," is for commercial and residential lighting. Surface or stem-mounted fixture with regressed housing; unit is shallow, 3¾ in. deep. Units may be installed individually or in continuous runs. Range of four sizes: 54 by 54 in.; 16 by 54 in.; 32 by 54 in.; and 30 by 30 in. Unit fully enclosed; shielding assembly swings down from either side for easy cleaning and relamping.

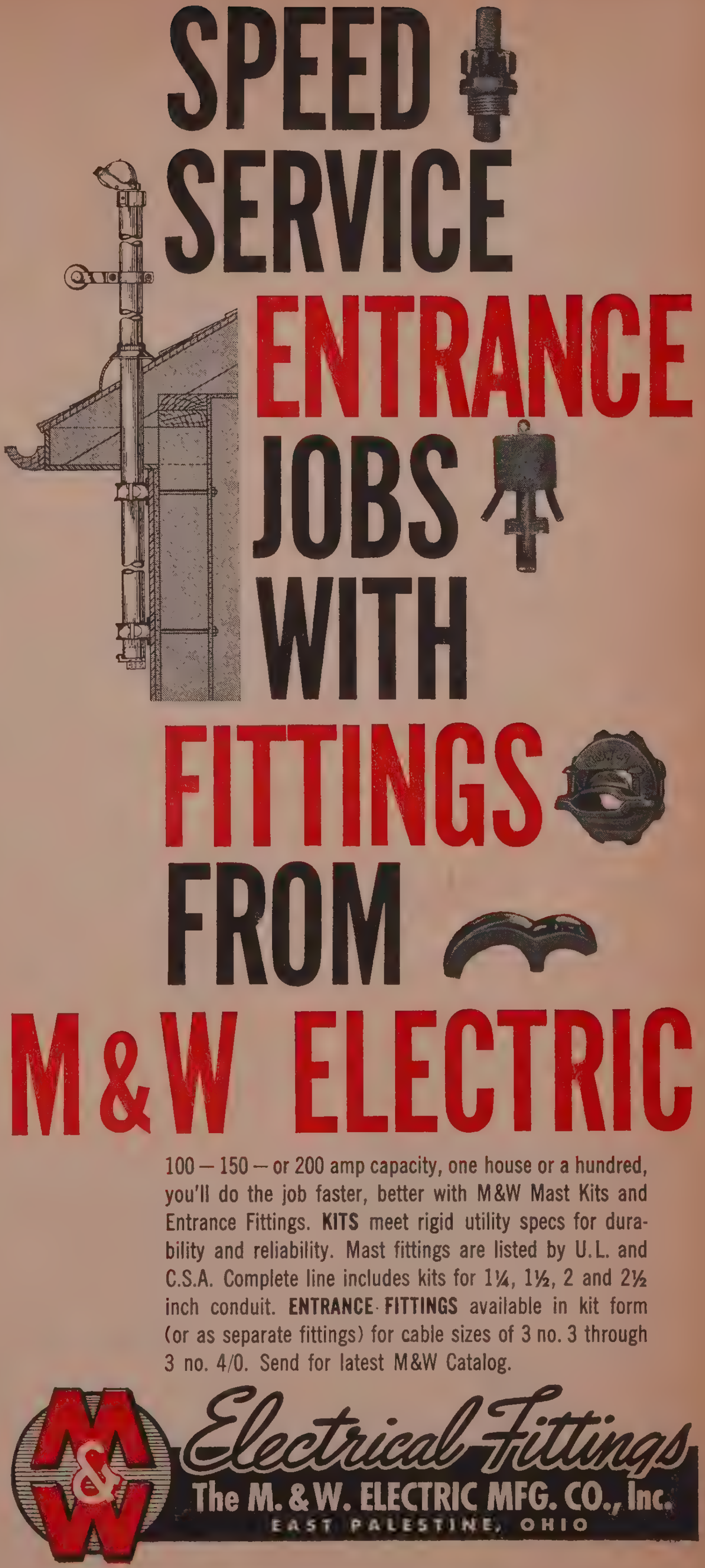
Lightolier Incorporated, Jersey City, N. J.



Motors **(32)**

This line of 3-phase, squirrel-cage induction motors has been expanded to include sizes from ½ to 125 hp. "Multiguard" protection, a specially compounded thermosetting plastic used to encapsulate and impregnate the stator, will be included on all motor sizes. Bearing and fabricated steel end bell design permit operating motor with shaft in either horizontal or vertical position. Sealed housing has a reservoir for grease storage and facilities for regreasing. Entire motor is coated inside and out with a vinyl based primer and an acid resistant paint.

Lincoln Electric Company, 22801 St. Clair Ave., Cleveland 17, Ohio



SPEED SERVICE ENTRANCE JOBS WITH FITTINGS FROM M&W ELECTRIC

100 — 150 — or 200 amp capacity, one house or a hundred, you'll do the job faster, better with M&W Mast Kits and Entrance Fittings. **KITS** meet rigid utility specs for durability and reliability. Mast fittings are listed by U.L. and C.S.A. Complete line includes kits for 1¼, 1½, 2 and 2½ inch conduit. **ENTRANCE FITTINGS** available in kit form (or as separate fittings) for cable sizes of 3 no. 3 through 3 no. 4/0. Send for latest M&W Catalog.

M&W *Electrical Fittings*

The M. & W. ELECTRIC MFG. CO., Inc.
EAST PALESTINE, OHIO

Outlets (33)

New 3-wire Electrostrip, providing electrical outlets anywhere along its length, is designed to meet electrical code requirements for equipment grounding. Manufactured especially for use with appliance and office machines, it contains provisions for equipment grounding. The 3-wire Electrostrip will also accept both two- and three-prong plugs. Electrostrip, a flexible multiple outlet assembly made of new extruded polyvinyl chloride, is rated 20 amps, 125 volts ac and is listed by UL. It mounts easily on any surface and is so designed to locate and relocate receptacles anywhere you wish.

BullDog Electric Products Div., I-T-E Circuit Breaker Company, Box 177, Detroit 32, Mich.

Heater (34)

A new oven-type plate heater bank assembly for air-conditioning ducts. Designated as Model 2-PO-AD, heater provides high capacity, low-watt density heat-exchange, with fast heat-up and with minimum restriction to air flow. Heater bank assembly, consisting of flat-plate-heaters mounted in tandem, can be made in varying heights, lengths and widths for installation in any size air duct. All heater surfaces are plated sheet steel and are electrically insulated. Heater plate thicknesses are 3/16 in.; distance between plates is determined by heating requirements. Heater banks can be connected for single-phase or 3-phase, 208, 220 or 440 volts. Heating coils are mica-insulated from sheet-steel plate coverings. Heater bank is easily installed in existing systems.

Electric Heater Specialty Co., 21 East 8th St., New York 3, N. Y.

Circuit Breaker (35)

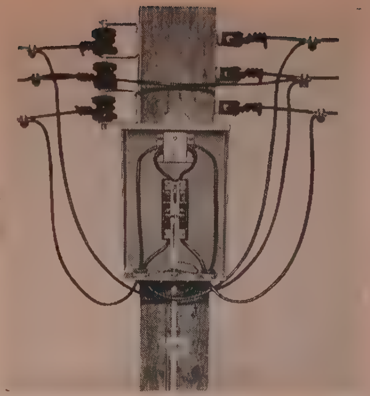
Mounting space requirements have been halved by new molded case circuit breaker, designated FJ-frame. It provides the ratings and features of J-frame in same physical size as that of FJ-frame units. Width of FJ breaker is 4½ in., length 10 in. and depth 4 1/16 in. FJ-frame breakers are available in 2- and 3-pole construction in current ratings of 70 to 225 amps, voltages of 600 volts ac and 250 volts dc. They are available in ET thermal-magnetic types and ETI instantaneous magnetic-only types with non-interchangeable trip. Standard features include enclosed terminals and front adjustable instantaneous trips. Pressure wire connectors, which will accommodate aluminum or copper conductors up to 300 MCM, are available for front connection of breakers in panelboards, individual enclosures and control cabinets. Rear connecting studs and plug-in connector assemblies are available for switchboard mounting.

I-T-E Circuit Breaker Co., Philadelphia, Pa.

Epoxy Adhesive (36)

A new epoxy adhesive that will enable an electrician to install a junction box in two minutes on tile or masonry walls or ceilings has been introduced. Coated with the adhesive, a junction box will remain on the wall, without sliding, after it has been held in place for five seconds. The new material is called Permacel Junction Box Mount. About 8 oz of material is enclosed in the divided cup package which is sufficient to mount eight to ten 4-by 4-in. junction boxes. The epoxy resin, after it has been mixed, remains usable for about 30 minutes. Curing time, at 70°, is three to four hours. Electrical box and mounting surface must be clean and oil free.

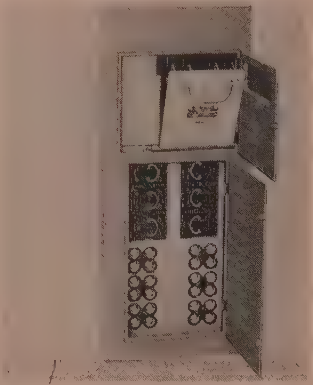
Permacel, a division of Johnson & Johnson, Brunswick, N. J.



Disconnect Switch (37)

A new pole top service disconnect switch, which can expand 60- or 100-amp service to 200 amps has been introduced. Two models are available, with or without a 200-amp current transformer. Each weatherproof switch is equipped with a 200-amp 2-pole magnetic trip circuit breaker, which can be tripped or reset from ground level by means of an extended length operating handle. Operating handle can be locked in either off or on position. Keyhole type mounting on top simplifies installation.

Midwest Electric Products, Mankato, Minn.



Switch (38)

New 200-amp door operated switch was designed for the all-electric Housepower home. Width is 14⅝ in. which means it will fit in between studs set 16 in. on center. This 200-amp fusible main is a 3-pole, 2-fuse, solid neutral, volts 120/240 ac service equipment device. It has 2-, 4- or 6-plug fuse circuits, also the plug fuse receptacles can be used for 240-volt heater circuits or 120 volts. Cabinet is available in either surface or flush mounting.

Wadsworth Electric Mfg. Co., Covington, Ky.

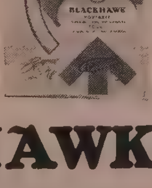
Almost 50% saving "just around the bend"

NEW Blackhawk 4" one-shot bender

Talk about spectacular savings — *you pocket more than $11 per bend over other methods.* This new Blackhawk bender pays for itself on just a couple of jobs. From then on it's gravy all the way.

This portable bender goes right to the job. You eliminate about half of the fittings, pipe threading and the time it takes to make connections.

Bends aluminum! You make exact 90° bends in steel or aluminum conduit in a single operation. A protractor-type "Optik-Angle" gage accurately measures the degree of bend in progress. And these benders are easy to handle due to lightweight, aluminum alloy construction, and lift-off frame top for quick pipe insertion.



CATALOG / MANUAL L-400 has full details on Blackhawk's family of time-saving, money-saving pipe benders.
Write Dept. P-2060 today for your free copy.

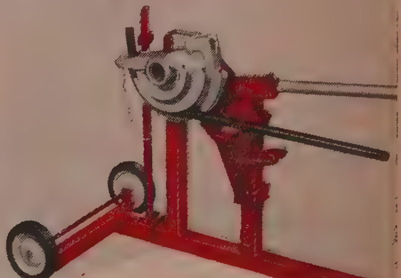
BLACKHAWK®

BLACKHAWK INDUSTRIAL DIVISION
13320 W. Reichert Pl., Butler, Wis.

OTHER NEW PRODUCTS

Take the guesswork out of hand bending

Here's Blackhawk's new rigid and thinwall hand bender that makes perfect 45° and 90° bends. As accurate as a carpenter's level, Blackhawk's Level Bender has unique double "bubbles" to do the figuring for you. You'll be amazed at the ease with which you make 90° bends, offset bends, saddle bends, back-to-back bends in ½", ¾" or 1" thinwall. Aluminum alloy construction is lightweight, yet built for hard work.



New Ratchet Rig saves on "ells"

Foolproof ratchet action makes perfect "ells," eliminating the extra expense of manufactured ells. The rig is easy to operate — anyone can do it after a few minutes' instruction. Lock-on shoes are quickly interchangeable to bend rigid conduit or aluminum. An "Optik-Angle" gage assures bending accuracy. Ratchet Rig is either portable or can be mounted on a pickup truck.

From $25 to $450 a year on Oil Alone . . . with a RIDGOILR!

How much oil do you use each day threading pipe, rod or conduit by hand or power drive?

One-half pint? One gallon? If it winds up on the floor, you're spending somewhere between $25 and $450 a year just for the privilege of cleaning up oil.

The RIDGOILR saves that money for you . . . lets you use all the oil you should!

- **Ends Oil Waste and Messy Floors**—Costly oil is double screened and re-used again and again.
- **Lengthens Die Life**—Well oiled dies last longer, stay sharper . . . gives cleaner threads for fast, easy installation.

The easy-to-carry RIDGOILR comes complete with a screened chip pan, circulating oil reservoir and hose-connected hand pump-gun. See it . . . buy it at your local Supply House. You'll be glad you did!

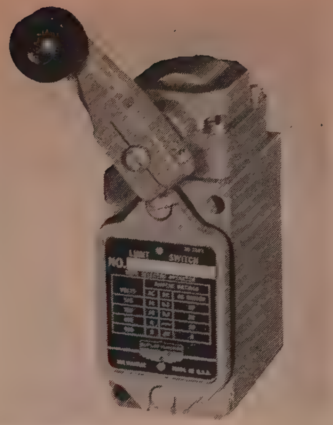
Costs Only $23.20

with 2 gallons of RIDGID Thread Cutting Oil!

RIDGID Dark and Nu-Clear Thread Cutting Oils are available in convenient (4 ounce Nu-Clear only), 1 quart, 1 gallon, (2 gallon Nu-Clear only), 5 gallon, 30 gallon and 55 gallon containers.

RIDGID®

The Ridge Tool Company, Elyria, Ohio, U.S.A.



Limit Switches (39)

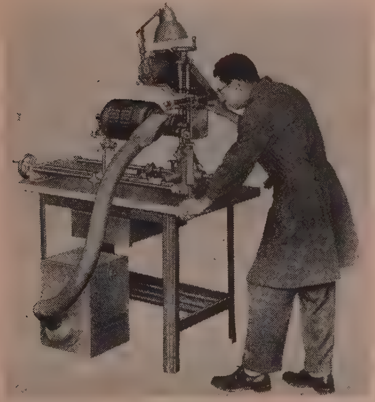
New line of limit switches specifically designed for applications on high-speed, precision production machines. Each switch is sealed to check seepage of oil, coolants, moisture and abrasive grit. Contacts are enclosed but visible. Switches, available in both surface and flush type mountings, are calibrated to control tolerances producing identical operation of all switches. Parts and assemblies can be interchanged from switch to switch or replaced without affecting subsequent performance. Also available are 14 different operating heads, including side and top pushbuttons, vertical and horizontal push rollers, adjustable and fixed roller levers. Operating heads may be mounted in any of four positions, 90 degrees apart. Booklet ED 143 is available.

Cutler-Hammer, Inc., 228 N. 12th St., Milwaukee, Wis.

Communication System (40)

A new school communication system that provides five simultaneous channels of communication. The SS4000 system, utilizing transistorized components, provides two sound channels, electronic voice intercom, room-to-room telephone facilities, and time and alarm signals. A feature of the system is a miniaturized multiple time channel pegboard for tying in classrooms with any one of six programs of time signals. A classroom may be changed from one program to another by changing position of a single patch cord on front-accessible pegboard. This miniature unit is built into classroom selector panel. Control center, a desk-type console or a rack, may be located in general office or elsewhere in school. Principal and other administrators may converse with any classroom from their desks. An alarm panel continuously monitors the signal-generating components. "Emergency-All Page" controls enable administrator to automatically override all other programs and signals regardless of how other controls may be set. For calls between classrooms and for confidential conversations with office, the full privacy room-to-room telephone system may be used.

Executone, Inc., 415 Lexington Ave., New York 17, N. Y.



Undercutter **(41)**

Bench-type undercutter, Model H-9, handles armatures up to 17-in. dia. It uses either high-speed steel or carbide saws and V-cutters. Maximum distance between centers is 32 in., V-supports 35 in. Saw lifts out of slot on each return stroke. Other features include easy spindle-speed change for high-speed steel or carbide saws, cutting head carriage travel on ball-bushings on hardened steel rods, carriage tips to side to facilitate placing of armatures on V-supports, and stops are provided to limit saw travel. It measures 4 ft long by 2 ft wide by 5 ft high including mounting bench. Two spindle sizes are available: 3/16-in. arbor for ½-in. dia. saws, 5/16-in. arbor for saw ⅞-in. dia or larger.

Martindale Electric Co., 1375 Hird Ave., Cleveland 7, Ohio

Compact RIDGID®
300 Power Drive with Accessories

Portable, Fast and Easy-to-Use, Low Cost. 1/8" to 2" Capacity; Power for up to 12" Geared Tools

Here's such an amazing power package that you'll have to try it to believe it. It's built around the compact, rugged RIDGID 300 Power Drive with famous RIDGID Speed Chuck that grips tight—forward or reverse, yet sets and releases easily by hand. Cam-action rear centering device holds even long lengths centered for perfect threads every time. Sturdy No. 1206 Stand folds for easy carrying . . . is extra rigid when in use.

RIDGID No. 310 Carriage, made of strong aluminum alloy, slides smoothly on drive support arms . . . holds die head and cutter ready for instant use. Snugs up tight to chuck for close threading and cut-off.

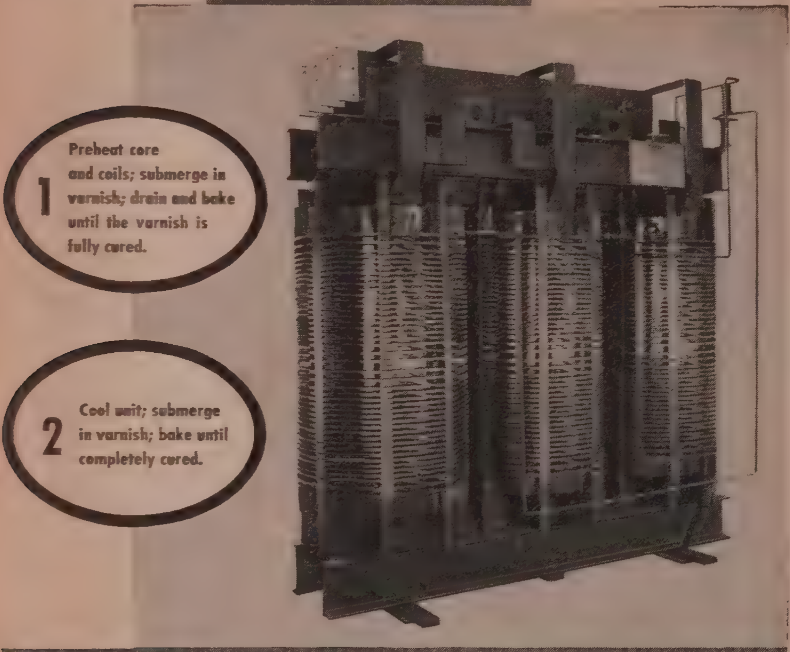
RIDGID 535 Quick-Opening Die Head, shown here, threads ½" to 2" pipe with just 2 sets of dies . . . adjusts to size right in machine . . . no fumbling for right size threader . . . no slow back-off. All other RIDGID Machine Pipe and Bolt Die Heads can be used. Add a RIDGID No. 19 Nipple Chuck, and you can thread close nipples.

RIDGID 360 full-floating Cutter has slide action that adjusts to all pipe irregularities . . . wide rolls for straight cuts at machine speed. Capacity: ¼" to 2" pipe and conduit—⅞" rod. E-1032 wheel for 1" rod available.

See and try this time-and-work-saving RIDGID 300 group at your Supply House!

RIDGID
The Ridge Tool Company, Elyria, Ohio, U.S.A.

TYPICAL OF **HEVI-DUTY** TRANSFORMERS


1
Preheat core and coils; submerge in varnish; drain and bake until the varnish is fully cured.
2
Cool unit; submerge in varnish; bake until completely cured.

Two impregnations with polymerizing varnish, baked twice for utmost protection

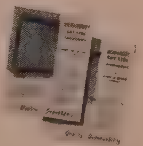
What makes a good transformer? For one thing—polymerizing *varnish* applied the Hevi-Duty way. It's another reason why Hevi-Duty transformers—single and three-phase up to 3000 KVA—have long service life and provide extra protection during periodic overload conditions.

At Hevi-Duty it's *standard practice* to specially treat the core and coil with a moisture and corrosion resistant polymerizing varnish. It's also standard practice to perform two separate baking operations. This assures complete and permanent impregnation so that there are no solvents given off after installation. Nor does the varnish soften under heat. Polymerization cross-links the varnish constituents, changing the soluble, penetrating resins into an infusible, insoluble mass of extreme bonding strength that cannot soften or run at extreme temperatures. The bonded molecules produce a compound that is dry throughout the most compact of coils, eliminating all soft or sticky spots. The resultant transformer is highly resistant to corrosion and impervious to attack from chemical fumes, alkalis, acids, salt water and oil.

Polymerizing varnish also has excellent dielectric properties and helps reduce the sound level by bonding the laminations and components together.

Long drying and baking cycles and the use of polymerizing varnish are standard features on Hevi-Duty transformers. You can be sure of obtaining these features by specifying Hevi-Duty transformers or by writing the following into your specifications: "Double Impregnate Coils and Core with Polymerizing Varnish; Bake until Varnish is Completely Cured."

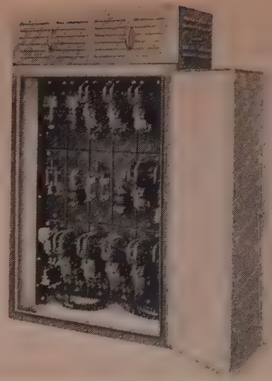
For more information on Hevi-Duty Dry Type Transformer design features, write for Bulletins 100 and 200.



HEVI-DUTY

A DIVISION OF BASIC PRODUCTS CORPORATION

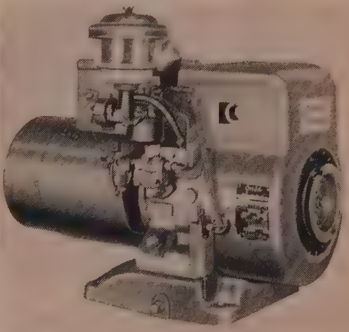
HEVI-DUTY ELECTRIC COMPANY, MILWAUKEE 1, WISCONSIN
Industrial Furnaces and Ovens, Electric and Fuel • Laboratory Furnaces • Dry Type Transformers • Constant Current Regulators



Controller **(42)**

A dc crane hoist controller, which operates on ac power, is available. Called Form HWR, it employs static rectifiers to supply dc power to a series-wound motor and its series-wound brake. This arrangement, because of inherent "blocking" characteristic of rectifiers, automatically increases motor stability for safe lowering of extreme overloads. Youngstown limit stops provide positive over-hoisting protection.

Square D Company EC&M Div., 4500 Lee Road, Cleveland 28, Ohio



Electric Plant **(43)**

A new remote-starting electric generating plant, designed specifically for home standby service. Having a rating of 2500 watts, the air-cooled 3600 rpm Model 205AJ is available in two different outputs: 205AJ-1R provides 2500 watts of 120-volt, 60-cycle, single-phase, 2-wire, ac; 205AJ-3R provides 2500 watts of 120/240-volt, 60-cycle, single-phase, 3-wire, ac. For the smaller hospital or institution, hotels, apartment buildings and modern offices where there is a minor requirement for emergency electric power to light hallways and corridors, entrances and exits, Model 205AJ unit can be used.

D. W. Onan & Sons, Inc., Minneapolis 14, Minn.

Transformer **(44)**

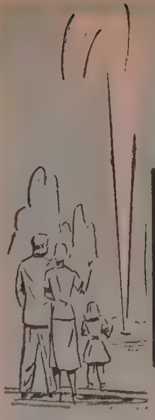
Weatherproof luminous tube transformer, a hermetically encapsulated unit, has been introduced. Temperature sensitive potting compound previously used in such transformers has been replaced with a thermosetting material which cannot run or drip. It is completely waterproof and impervious to shock and possesses dielectric properties and resistance to arc tracking exceeding UL requirements.

Jefferson Electric Company, Inc., Bellwood, Ill.

Outlet **(45)**

Model 54 power outlet is designed for mobile home park and provides 125/250-volt electrical service plus a panel for mounting a meter inside the weatherproof enclosure. Weatherproof enclosure has a 50-amp, 125/250-volt "Life-Line" park receptacle in the bottom, plus a 15-amp, 125-volt grounded duplex outlet on inside panel. Overload protection for outlets is provided by a fuse pullout and fuse holder. A model is also available with a 50-amp, 250-volt receptacle on panel. An "A" base meter is easily mounted on plywood subpanel. Box cover has a window for meter reading. Cover can be padlocked. Junction-Post for mounting unit is available separately. Serving as a junction box, post has pressure connectors up to No. 4/0 wire.

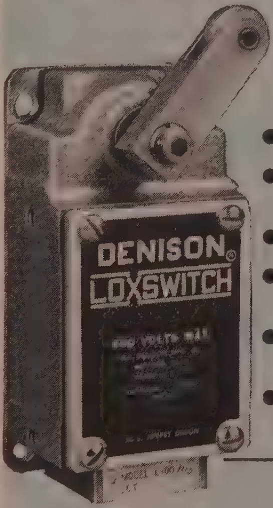
Hoffman Engineering Corp., Anoka, Minn.



One word explains the popularity of these switches...

Dependability!

Denison LOXSWITCH Limit Switches operate with the dependability of Old Faithful. Oil- and dust-tight features, superior electrical characteristics and mechanical design result in three to five times longer life than comparable switches.



L100W HEAVY DUTY LIMIT SWITCH

- 45 CIRCUIT ARRANGEMENTS.
- LONGEST CONTACT LIFE due to lowest impact of 2.5 grams and minimum "bounce".
- WATER-, DUST- AND OIL-TIGHT, NEMA 12.
- ONLY FOUR MOVING PARTS. Longer life, easier to maintain.
- 70° SAFETY OVERTRAVEL without use of extra springs or cams.
- OVER 150 LEVER STYLES.

MODEL M PRECISION LIMIT SWITCH

- LONG MECHANICAL LIFE nylon latch mechanism.
- 600 VOLT INDUSTRIAL CONTROL RATING.
- COMPLETELY ISOLATED CIRCUITS.
- 6° TRIP DIFFERENTIAL, 50° overtravel in both directions.
- PRECISION REPEATABILITY ± .001".
- WATER-, OIL-, DUST-TIGHT — NEMA 12.
- FULLY INTERCHANGEABLE with thousands of existing layouts.

BOTH MODELS AVAILABLE WITH PLUG-IN CONVENIENCE

Write for literature describing our complete line.

Address R. B. DENISON MFG. CO., 386 Broadway, Bedford, Ohio

DENISON LOXSWITCH

*Wire with **LOXSWITCH** and you wire for good!*

General Electric
1201 Glyptal®
Red Enamel Gives

Fast Insulating Protection

You get high dielectric strength plus tough physical and chemical protection—quickly and easily—when you apply G-E 1201 Glyptal Red Enamel. A recent industry-wide survey proves "1201" rates tops in:

☑ Quality
☑ Performance
☑ Availability
☑ User Preference

Readily available Glyptal Red Enamel *applies easily*—spray, brush or dip. It's *quick drying*, too, and gives a lasting, protective finish.

Depend on Glyptal Red Enamel for better protection . . . better service. Ask for immediate delivery from your local Authorized General Electric Insulating Materials Distributor. Or, for free bulletin on G-E insulating paints and finishes, write Section 108D, General Electric Co., Riverview Plant, Rotterdam, N. Y.

845-09

GENERAL ELECTRIC

Midwest ALL-PURPOSE WEATHERPROOF POWER OUTLETS

MODEL P55C

TOP QUALITY POWER OUTLETS

for Outdoor Construction, Industry Farms, Ranches, Mobile Home Parks.

MODEL P55C illustrated—has 60 amp, 250 volt, 4 wire receptacle, protected with a two pole 50 amp circuit breaker. Also has a grounded type duplex receptacle protected with a one pole 20 amp circuit breaker. Overhead and underground connections easily made by use of Top Hub and Bottom KO's. Completely weatherproof . . . cover closes over switches and receptacles and when padlocked, unit is tamper-proof.

Over 100 other Standard Models—Fused or Circuit Breaker Types with 15 to 60 amp, 3 and 4 wire receptacles.

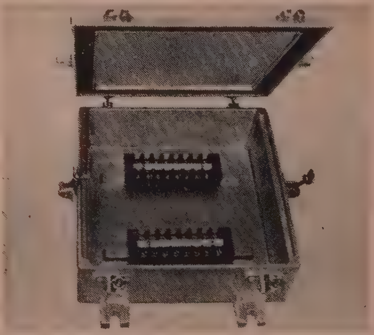
See Your Local Electrical Distributor Or Write...

Midwest
ELECTRIC PRODUCTS, INC.
DEPT EC, MANKATO, MINNESOTA

Recessed Fixtures (46)

Three new Emerson-Pryne snap fixtures for both new construction and remodeling are available. All components are designed to snap into place quickly. For new construction, mounting straps snap onto frame and are nailed between joists. For remodeling jobs, fixture snaps into plaster board. Two 100-watt models are available. Model 1082 has a square 9-in. housing. Model 1083 has a rectangular 7- by 10-in. housing. The 150-watt unit, Model 1084, has a square 11-in. housing.

Emerson Electric Mfg. Co., 8100 Florissant Ave., St. Louis 36, Mo.



Terminal Cabinets (47)

Hinged terminal cabinets for thermocouples and control are now available in 17 sizes for use on from 2- to 180-wire systems. A feature of this line is the placement of blocks which permit ample wiring spaces for wires up to 30 amps, 600 volts, weatherproof construction and exterior mounting lugs. All boxes are of galvanized cast iron.

Hope Electrical Products Co., 39 Long Ave., Hillside, N. J.

Switch (48)

New 5- and 15-kv indoor and outdoor switchgear (Type P) with rollout load break disconnect switch for convenient maintenance. Basic available circuit arrangements include a single unit with line and load connections from above or below; a feeder unit, including main bus and load connections from above or below; a load center substation transformer unit with

82-in. throat connection to transformer, left or right hand, and line connection from above or below, and an auxiliary unit to house instrument transformers and other accessories. All units have a metering compartment at top with 20-in. panel space and approximately 8-in. clearance behind panel. Provision is made for one current transformer per phase for metering located in cable entrance compartment, for a maximum of one pothead for line connection and one for load connection, for cable lugs to both line and load sides, not to exceed two 500 MCM lugs per phase or equivalent.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Clamp (49)

The Adjusto-clamp is designed for use in anchoring service entrance masts to sides of structures which allows straightening the mast after installation, or aligning mast with meter socket even when bolt hole is drilled a bit off the vertical. It is made of pressed steel and is hot galvanized. Adjusto-clamps are included as standard items in all 2085 Mast Kits and are available separately for 2- or 2½-in. pipe.

Porcelain Products Co., 225 N. Patterson St., Carey, Ohio

Lighting Fixture (50)

New SDLO series fixtures are semi-indirect, and utilize the 45 by 45 degree minicell plastic louver. The series is recommended for schools, offices, showrooms, lobbies, and wherever semi-indirect lighting is desired. Open-top design, with its side ballast channels, eliminates center striation, louver diffuser cells allow dust and dirt to circulate through. Fixtures can be surface mounted or suspended by stems, either individually, in continuous rows, or in modular panels. Fixtures come in 48-, 72- and 96-in. lengths, in either 2-, 3- or 4-lamp, rapid start, slimline or regular fluorescent.

Leadlight Fixture Company, 800 -100th Ave., Oakland, Calif.

Finished in coral tan baked-enamel, the Chromalox Unit Ventilator is available in four sizes providing heating capacities from 2,700 to 61,500 BTU/HR.

CHROMALOX ELECTRIC UNIT VENTILATOR

HEATING, VENTILATING AND NATURAL COOLING

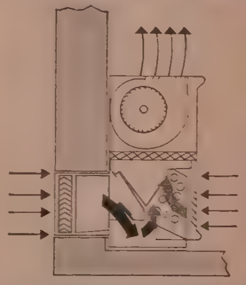
FOR YEAR 'ROUND OFFICE COMFORT

Here is the simple answer to even complicated heating and stuffy room air problems. In one compact package, the Chromalox Electric Unit Ventilator provides all-season comfort for rooms larger than 5,000 cubic feet. Without boilers, pipes, ducts, flues or compressors . . . this unit draws fresh, filtered, outdoor air to supply ventilation and heat in cold weather, and natural cooling in mild weather. Operation is completely automatic, by built-in thermostat and clock controls.

The unit is ideal for partial remodelling or new building additions, since it operates completely independent of existing heating and cooling systems.

Economical, too. Initial cost is quite low compared to other methods. Simple installation adds further economy. (1. Cut wall opening for louvered air intake. 2. Fasten two bolts to wall. 3. Connect power and control wires.) This unit can also reduce the operating cost of refrigeration type air-conditioning. In the early-morning hours, the Unit Ventilator draws in cool outside air to purge stale, hot air of the previous day. When new work-day begins, refrigeration-type cooling again takes over.

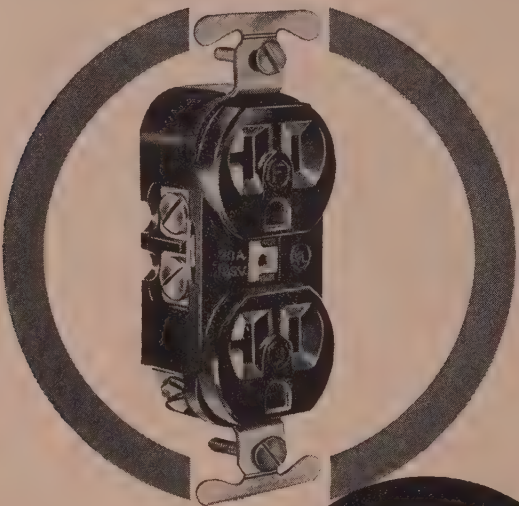
Chromalox has other electric heating equipment available for semi-recessed or fully-recessed wall or ceiling mounting. Write today for more information. 91892

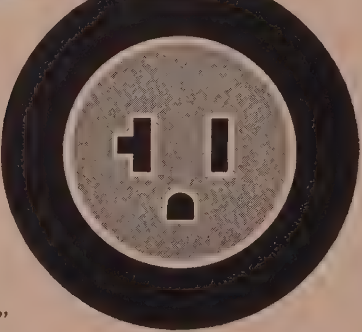


Arrows indicate manner in which fans draw outdoor ventilating air through louvered wall opening, mix it with recirculated room air through bank of metal sheath Fintube electric heating elements, through filter, then upward and outward into room.

CHROMALOX ELECTRIC HEAT
Edwin L. Wiegand Company
7500 Thomas Boulevard • Pittsburgh 8, Pa.

NEW
CIRCLE F
20-AMP
"U"-GROUND DEVICES



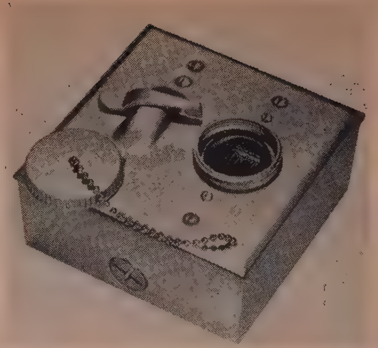


. . . Section 220-3 (b) of the 1959 National Electrical Code states . . .

"For the small appliance load in kitchen, laundry, pantry, dining room and breakfast room of dwelling occupancies, (1) 2 or more 20-ampere branch circuits in addition to the branch circuits specified in paragraph 220-3 (a) shall be provided for all receptacle outlets (other than outlets for clocks) in these rooms, and such circuits shall have no other outlets."

Designed to provide full compliance with the revised Code, Circle F's *new* No. 2532 does much more! It becomes a "universal" outlet! It accommodates appliances, heavy-duty portable tools, business machines, etc., having substantial energy requirements, where the new 20 A.-125 V. plug cap (No. 2528) is necessary. It also accommodates 15 A.-125 V. 3 wire U-ground and standard parallel blade caps. One outlet for all! Circle F's quality is tops and the price is right. Contact your Circle F representative for complete details.

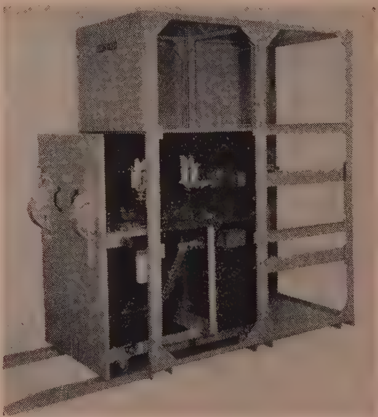
CIRCLE F MFG. CO.
TRENTON 4, NEW JERSEY



Switch (51)

New automatic electronic switch, Model LTS 104, for all outdoor lighting control applications requiring emergency switch provision. It controls lighting loads of up to 1000 watts and is for use for airstrip, industrial plant and defense installation lighting control. A chained screw-cap is provided for daylight tests and a built-in delay acts to avoid accidental switching. Featuring an hermetically sealed photoelectric control, a quality "T"-rated emergency on-off switch, a die-cast aluminum screw-cap and "T"-box, and a corrosion-resistant, aluminum finished brass cover, unit comes complete with 2½-in. plugs.

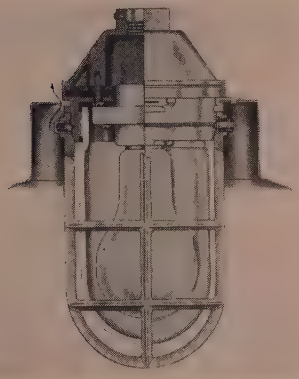
Solar Sonic Devices, Inc., Hicksville, L. I., N. Y.



Switch (52)

New air interrupter switch has a removable switch and fuse element designed for services up to and including 14,400-volt range, which gives operator safety for servicing electric system. To service electrical system, entire truck-mounted switch and fuse assembly is manually rolled out of cubicle onto floor. Six stationary contacts are each enclosed in a Micarta tube. As truck is withdrawn, a hinged Micarta cover automatically drops into place. This forms an insulated barrier between all live parts and anything outside the barrier. A new principle of toggle action increases the switch's capacity to withstand fault currents. Two spring-loaded toggles operate one in advance of the other. Entire truck-mounted 3-pole switch and fuse assembly is housed in a 10-gauge steel cubicle, 36 in. wide, 74 in. deep and 90 in. high.

Continental Electric Equipment Co., 205 West Fourth St., Cincinnati 2, Ohio



Fixture **(53)**

A new complete line of vaportite industrial lighting fixtures with or without porcelain reflectors. Units feature all aluminum die cast bodies and guards, engineered to permit relamping and cleaning without aid of tools. They are available in 100- or 200-watt types for pendant, wall or ceiling mounting. Wall and ceiling units are attached to outlet box cover or to cast aluminum box having four ½- or ¾-in. tapped hubs. All white, ventilated porcelain enameled reflectors — standard dome, shallow, deep bowl and angle —are equipped with self-locking nylon shoes for attachment.

Steber Manufacturing Co., Broadview, Ill.

Motors **(54)**

A new line of inherent automatically protected motors, 3-phase, ¼ through 3 hp, ac, consists of 67 different types of open motors in a wide variety of voltages, speeds and mountings. UL approved. Protector is assembled and completely wired, inside the motor, at the factory. Motors are suited for all 3-phase applications, including pump, machine tool and air-conditioning industries. Bulletin M-1986A is available.

Kingston-Conley, Inc., 900 North Ave., Plainfield, N. J.

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"58"
"68"
"88-A"

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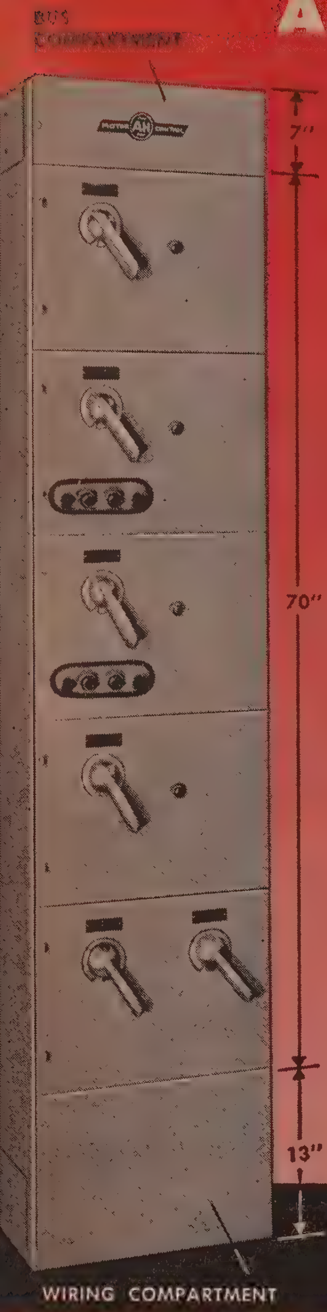
ARROW (AH) HART

CONTROL CENTERS

TYPE "MC"



these advantages will help you

MUCH GREATER SPACE SAVINGS . . . because the Arrow-Hart Motor Control Units in these Control Centers are half the size and weight of comparable controls. *ARROW-HART* offers a control center with up to 10 Size 1 control cells in a single vertical section 90" high.

FASTER, LOWER-COST INSTALLATION . . . because all controls are delivered in a single pre-tested, ready-to-install "package." If specified, all interwiring, sequencing, interlocking etc. are pre-engineered.

GREATER DEPENDABILITY . . . because of the superior performance of the individual Arrow-Hart Control Units and simplified maintenance because all controls are centralized in a single convenient location, away from shop dust and dirt. Individual cells are plug-in type for quick removal, replacement or re-assembly.

COMPLETE FLEXIBILITY, VERSATILITY . . . practically any desired combination of units can easily be assembled . . . or modified.

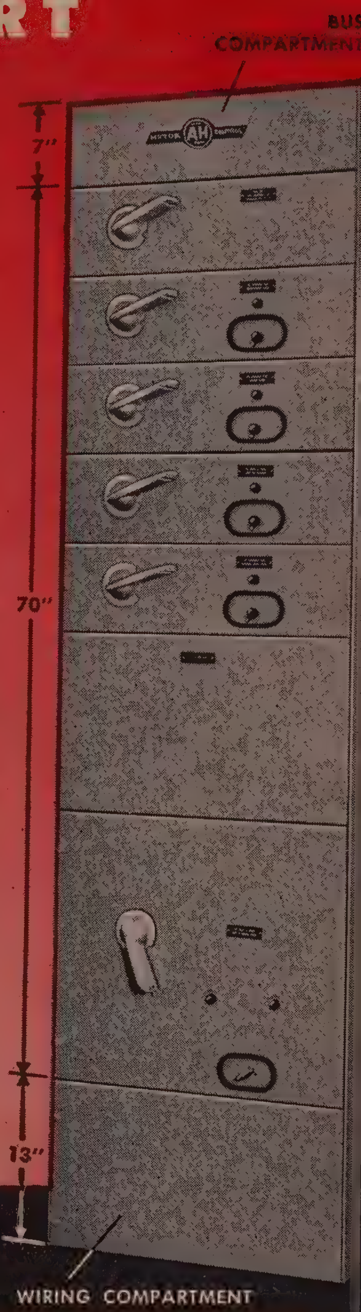
MOST COMPLETE LINES AVAILABLE ANYWHERE . . .

COMBINATION STARTER UNITS: Non-Reversing, Reversing, 2-Speed, Part-Winding, and Reduced Voltage Starter Types in NEMA Sizes 1 through 5 . . . in combination with Fused or Unfused Disconnect Switch or Circuit Breaker of Thermal Magnetic or Instantaneous Trip Type.

ENCLOSURES: NEMA 1 (General Purpose), NEMA 1-A (Semi-Dustight), NEMA 3 (Outdoor), NEMA 5 (Dustight), and NEMA 12 (Industrial Use) — in standard or back-to-back arrangements.

WIRING: NEMA A, B or C — Class I or II.

OTHER CONTROL UNITS: Include Lighting Panels, Transformers, Metering Equipment, and a Complete Line of Pilot Devices.



TYPE MC-5
20" WIDE
Up to 5 Size 1
Control Cells

preferred for most general purpose industrial applications.

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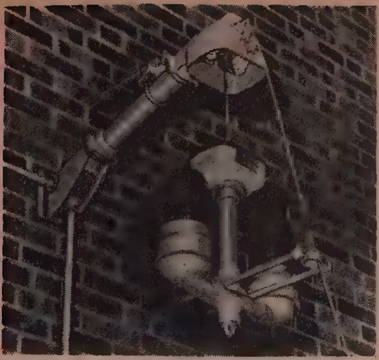
APPLIANCE SWITCHES · WIRING DEVICES

TYPE MC-10
25" WIDE
Up to 10 Size 1
Control Cells

preferred for schools and other commercial, and institutional applications that call for maximum space savings.



Light Fixture (55)

Type VAW disconnecting obstruction light fixture for use with the Thompson disconnecting hanger is recommended for installation on poles, towers, stacks, water tanks and other high obstructions on or adjacent to airfields or along airways. Fixture with hanger makes it possible to perform cleaning and relamping of obstruction lights at ground or convenient level. Type VAW is furnished with red globes for use as an obstruction light, but may be furnished with clear, yellow, green or blue globes to meet other job requirements. A transfer relay is available which allows only one lamp in the unit to burn at a time. When the first lamp burns out the reserve lamp is automatically switched on. Lamps are available rated up to 6000 hours life.

Crouse-Hinds Company, Syracuse 1, N. Y.

Housing (56)

Newly developed "Fitall" housing is designed to fit virtually all round, recessed lighting requirements. Over 16 different trims can be installed on this one housing: 75-watt R-30, 150-watt R-40, showerlites, standard lamp rounds, eyeball and gimble rings, pinholes, etc. Housing can be used for this wide variety of installations by a

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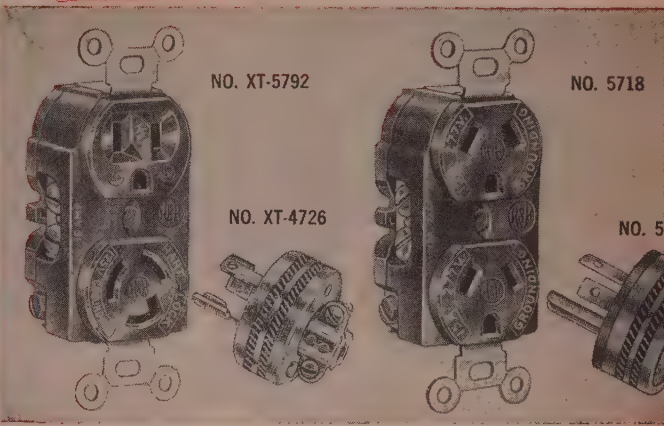

COMBINATION 3-WIRE GROUNDING HART-LOCK RECEPTACLES and CAPS, 15 AMPS, 125 VOLTS.

One side of this combination receptacle is 3-wire grounding Hart-Lock with 2 green hex ground screws and the other side is conventional 3-wire, 2-wire grounding 15 amps, 125 volts. Where limited space requires a duplex receptacle to provide both grounding and accidental disconnect protection and conventional U-shape grounding.

3-WIRE DUPLEX GROUNDING RECEP TACLES and CAPS—15 AMPS, 27 VOLTS.

New from A-H, this line of wirin devices is specifically designed t provide new standards of safet and dependability for industria and commercial fluorescen lighting fixtures of the discon necting type that operate on 22 volts.

"H & H" Specification Grade

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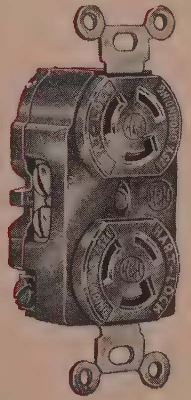
3-WIRE GROUNDING RECEPTACLES, CAPS and CORD CONNECTORS

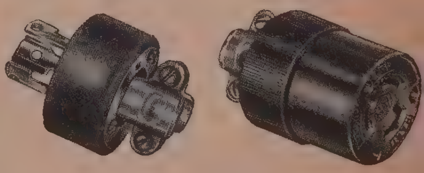
Ideal for applications that require positiv grounding *plus* locking to prevent accidenta disconnect. Configuration prevents interchange ability with similar devices having differen ratings. Meets latest code requirements.



NO. XT-4700

NO. XT-4720

NO. XT-4731



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Dept. ECM, The Arrow-Hart & Hegeman Electric Co.
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The Original Klein Side Cutting Plier—Also available in NE (Streamlined) type. Cat. No. 201

High Leverage Plier—Extra high leverage permits cutting extremely tough wire. Also available in the standard type as shown above. Cat. No. 213-9NE

High Leverage Oblique Cutting Plier—A recently introduced plier designed to cut toughest wire. Cat. No. 228-8

Electrician Conduit Plier—Reams inside and outside of conduit, tightens lock nuts in outlet boxes. Cat. No. 333-8

"Since 1857" the name Klein has stood for the finest in tools and equipment for linemen and electricians. It is the uncompromising high quality back of the name Klein that has won Klein Pliers their place in the hands of men who know good tools. Klein Pliers are now available in a wider variety of styles and sizes than ever before. Be sure the pliers you need carry the Klein trade-mark.

Klein Catalog Free—This new Klein catalog giving complete information on Klein tools and equipment for linemen and electricians will be sent on request. Write for your copy.

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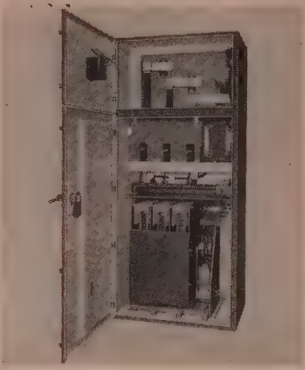
vertically adjustable socket plate. Housing is available both prewired or unwired. Literature is available.

Halo Lighting Products, Inc., 4201 West Grand Ave., Chicago 51, Ill.



Starter (57)

A high-voltage air-break starter which combines fuseless fault protection with simplified servicing is available. Certified interrupting capacity of Type ZHA starter is 100,000 kva at 2400 volts and 150,000 kva at 4800 volts. Phase barrier and arc-chutes slide out horizontally, eliminating rollout and providing easy inspection and maintenance. Both front and rear contact tips are accessible. Since all maintenance can be done from the front, starters can be mounted against walls or back-to-back. A 3-way door-interlock gives positive personnel safety. With door open, blades are visible in open and grounded position. Bus bars are used throughout. Bulletin 8130-A.

Square D Company, EC&M Div., 4500 Lee Road, Cleveland 28, Ohio

Outdoor Lights (58)

New die-cast aluminum outdoor cluster lights are designed for wide area floodlighting in hospitals, churches, restaurants, motels, hotels, residences and other outdoor or indoor locations where weatherproof performance is required. Fixtures are available in three contemporary styles in a wide range of colors. All units are silicone-sealed for face-up protection in rain, snow or sleet, and fully vented for cooler, cleaner operation. New line accommodates up to 300-watt reflector lamps and is fully UL-approved for outdoor service.

Stonco Electric Products Co., Kenilworth, N. J.

Product Briefs

(59) F&M Electric Products Corp., North Riverside, Ill., announce complete Klein service **mast kits** which are aluminum or hot-dipped galvanized. . . . (60) 12 and 18-in. **masonry drills** are made by Holub Industries, Inc., Sycamore, Ill.

(61) Perfect-Line Mfg. Co., Hicksville, L. I., N. Y., has introduced a new weatherproof lock-cover **duplex assembly**. . . . (62) A new 1½-in. entrance head on a 2-in. **hub** (for 2-in. masts) has been announced by Allen-Stevens Conduit Fittings Corp., Woodside, N. Y. . . . (63) Keystone Mfg. Co., Warren, Mich., has expanded its line of liquid-tight "JIC" flanged Hinged-Latched-Cover **wireways** by adding a complete new line of auxiliary fittings for these wireways. . . . (64) New heavy-duty hydraulic **power pumps** delivering 10,000 psi continuous pressure are announced by Greenlee Tool Co., Rockford, Ill.

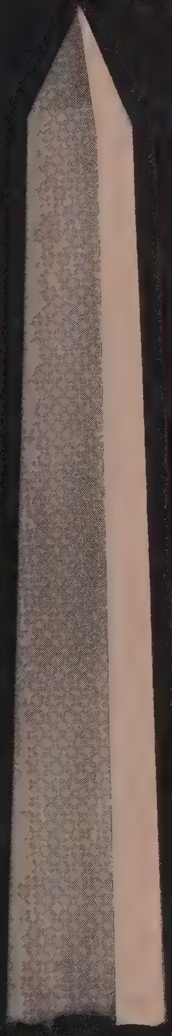
(65) General Electric Co., Cleveland, Ohio, has extended its line of **outdoor fluorescent lamps** to include 4-, 6- and 8-ft types. . . . (66) A new lightweight current **transformer** (Type TWM) for indoor-outdoor light-duty metering has been introduced by Allis-Chalmers Pittsburgh Works, Milwaukee, Wis. . . . (67) Swivelier Co., Inc., New York, N. Y., has introduced a new line of adjustable **Hospital-Lites**. . . . (68) A new type color improved **mercury lamp** has been developed by Radiant Lamp Corp., Newark, N. J.

(69) General Electric Co., Bridgeport, Conn., has announced a new Type SO **portable cord**. . . . (70) A safety multiple **lockout device** for use on all electric switches and fuse boxes available from Industrial Products Co., Philadelphia, Pa. . . . (71) Vulcan Electric Co., Danvers, Mass., has a new line of cylindrical **band heaters** especially for plastic molding and extruding machines. . . . (72) New lightweight magnesium **cable reel dolly** is made by Magnesium Co. of America, Hialeah, Fla.

On a job like the Washington Monument...

Seal & Company, Inc. figures costs closely

...but doesn't take chances!



From tip to base, the 555 ft. Washington National Monument glows after dark with a complete new floodlighting system installed by one of the capital's most respected electrical contractors, Seal & Company, Inc. From the transformer vaults, to the four main floodlight clusters, the four pairs of fixed searchlights, the 555 ft. risers—each spliced in 10 pull boxes—and the aircraft warning lights at the top, Seal & Company used—naturally—Burndy connectors. Their cost was only a tiny fraction of the whole job... but they're the vital links that will make the Washington Monument a nighttime landmark for years to come.

"The electrical connectors accounted for only a fraction of 1% of the cost of the Washington Monument job...but everything depends on them. We had too much at stake here to even think of taking chances ...we played it safe by using Burndy."

—Frank Seal, President; Seal & Company, Inc.

Washington National Monument, Seal & Company, Inc., electrical contractor.
Kluckhuhn, Cobb & McDavid Co., Wash., D.C., Engineering Consultants, designers.

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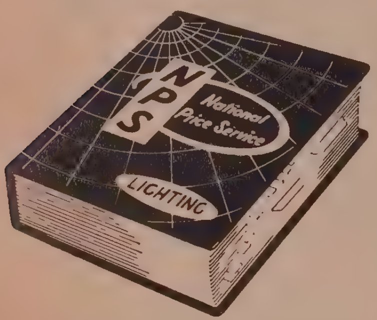

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(73) Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill., has introduced a new pulse-producing **snap-action switch.** . . . (74) "Penetrox," an aluminum conduit **lubricant** which eases installing and seals joints has been developed by Burndy Corp., Norwalk, Conn. . . . (75) Westinghouse Electric Corp., Pittsburgh, Pa., has announced a new 100-kvar single-phase **capacitor** available in ratings from 2400 through 7960 volts. . . . (76) New high-temperature mercury-lamp **ballasts** are now available from General Electric's Specialty Transformer Dept., Fort Wayne, Ind.

(77) The Adalet Mfg. Co., Cleveland, Ohio, has developed a line of "Wedge lock" **cable supports** for use on vertical conduit runs. . . . (78) A complete line of tapered steel **lighting standards,** mast arms and brackets for street, highway and commercial lighting installations is being produced by Valley Mfg. Co., Valley, Neb. . . . (79) The Brown Mfg. Co., Inc., Woodbine, Iowa, is marketing a new and larger model of its Bus Brown **trencher.** . . . (80) New flexible **steel conduit,** UL approved, for protecting electrical wiring in wet areas, has been developed by the International Metal Hose Co., Bellevue, Ohio.

(81) Stanley Electric Tools, New Britain, Conn., has announced a new line of 16 portable **power tools** for industrial use. . . . (82) A **portable scope dolly** which features three power outlets accommodating all popular type laboratory oscilloscopes, has been introduced by the PBR Mfg. Co., Philadelphia, Pa. . . . (83) Edwin F. Guth Co., St. Louis, Mo., announces its new Mystic Gratelite **louver diffuser.** . . . (84) A vinyl ground **wire moulding** called P-Class Ground Wire Moulding has been developed for utility poles by the Virginia Plastics and Chemical Co., Roanoke, Va.

(85) The Electric Storage Battery Co.'s Automotive Div., Detroit, Mich., has announced a new device called the Activerter. It is a portable source of 110-volt ac power and unit combines a **storage battery** with an electronic device. . . . (86) A new line of powder-actuated **hand tools** for fast anchoring of wood or metal to concrete or steel is offered by the Nelson Stud Driver Div., Gregory Industries, Inc., Lorain, Ohio. . . . (87) D. W. Onan & Sons, Inc., Minneapolis, offers a **voltage relay** with 2-way line transfer control.

Catalogs & Bulletins

(88) ENCLOSURES and panels. Catalog 33-1960 lists 3500 standard items plus custom consoles. H. F. Cox Co.

(89) MI CABLE. New catalog shows uses in industry and hazardous areas and instrumentation. General Cable Corp.

(90) TRANSFORMERS. Bulletin D-360, 6 pages, includes description, photographs and connection diagrams of Lawn-master Pole Star surface-mounted distribution units for underground distribution systems. Pennsylvania Transformer Div., McGraw-Edison Co.

(91) LAMPS, incandescent and fluorescent, for the home. 16-page reference guide describes all types of lamps, their sizes, shapes, ratings, light outputs, life, and color quality. Westinghouse Electric Corp.

(92) TRANSFORMERS with tapped windings for providing standard 115 and 230 volts from available supply circuits that are off-standard are described in Bulletin 162-B01. Acme Electric Corp.

(93) UNIT SUBSTATIONS. Bulletin GEA-3592L, 32 pages, gives detailed information on features, operation, and application of new load center units. General Electric Co.

(94) TWO-WAY RADIO. Mobile base station equipment and accessories are covered, with specifications and photographs, in new booklet. Motorola, Inc.

(95) BUSWAY. Application data for plug-in, low-impedance, high-frequency busway is contained in 12-page booklet 30-660. Westinghouse Electric Corp.

(96) INSULATION for electrically heated homes. Instruction booklet covers problems presented by conditions of greater air change and window areas. Forty-Eight Insulations, Inc.

(97) SCAFFOLDS of aluminum, including section and folding types, are described in Bulletin AS-10. Patent Scaffolding Co., Inc.

(98) UNIT SUBSTATIONS. Ratings, weights and dimensions are included in workbook for efficient planning of low-voltage substations for both indoor and outdoor applications. Pennsylvania Transformer Div., McGraw-Edison Co.

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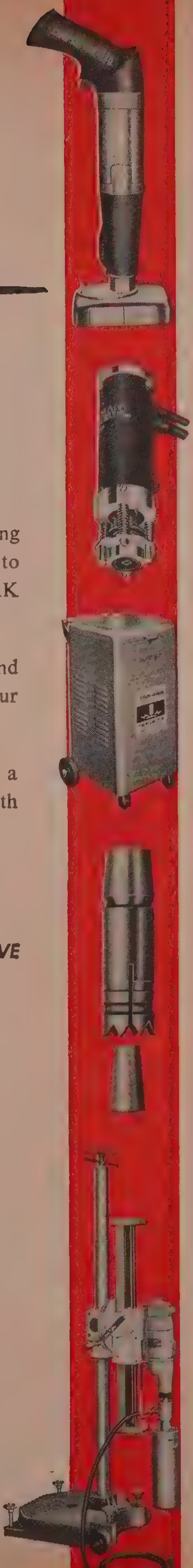

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Portland 22, Oregon

Eastern Distribution Center
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SEE THE YELLOW PAGES UNDER "TOOLS" FOR YOUR OMARK DEALER'S NAME

(99) Electric Heating costs are estimated for 105 major cities and marketing areas, broken down by outdoor design temperatures, in new booklet. Sun-Tron Corp.

(100) Connectors, clamps and fittings—complete line is covered in new pocket-sized general catalog. Anderson Electric Corp.

(101) Lighting Fixtures. Vapor-tight aluminum pendent, ceiling and bracket types in full range of reflector styles, plus accessories, are detailed in new catalog. Killark Electric Mfg. Co.

(102) Load Centers. New 36-page catalog describes centers rated up to 400 amps including units with isolated water heater circuit, single-phase units with 3-phase air conditioning circuit, and 200-amp units with branch circuits. Walker Div., I-T-E Circuit Breaker Co.

(103) Street Light Globes of unbreakable fiberglass are shown in new 4-page brochure. Plastic Age Sales, Inc.

(104) Housepower Use-Planner for electrical contractors. 6-page folder gives directions on how to plan outlets for immediate and future requirements, including room layouts for sketching in furniture, appliances and lamps, plus a comprehensive list of appliances with their wattages. Wiremold Co.

(105) Induction Motors. Bulletin GEC-1049, 14 pages, gives selection, application and buying data for single- and 3-phase $\frac{3}{4}$- to 150-hp motors. General Electric Co.

(106) Outdoor Lighting. New 8-page catalog covers cast aluminum fixtures with enclosed louvers and lenses. Moldcast Mfg. Co.

(107) Time Delay Relays. New catalog gives engineering data and application data on line of thermal-type relays. Thermal Controls, Inc.

(108) Signs and Markers. 24-page catalog provides complete information on adhesive-backed markers in color for such applications as conduit, motors, and panelboards. North Shore Nameplate.

(109) Plastic Lighting equipment. 10-page loose-leaf catalog describes and gives photometric data on prismatic lenses, panels, and extruded shapes. K-S-H Plastics Inc.

(110) Concrete Drilling rotary-impact tool with an average drilling rate of 1 in. per min. is described in 4-page folder. Bill Jack Scientific Instrument Co.

(111) Lifting Magnets—their repair and modernization. Booklet B-7757. Westinghouse Electric Corp.

(112) Lighting Fixtures. 70-page catalog No. 559 gives dimensional, descriptive, and ordering information on industrial, commercial, and residential lines. Duray Fluorescent Mfg. Co.

(113) Wire and Cable, including power cables up to 5 kv, control cables, street lighting cable, and portable power cables, are covered in 52-page Catalog WC-859. Walker Bros.

(114) Underfloor Raceway. Distribution system components for power, telephone and intercom cables are described in Bulletin 517, 20 pages. National Supply Co.

(115) Insulating Varnish for Class F, B, or A use on motors, transformers and generators, is covered in Bulletin SV-116, 6 pages. Schenectady Varnish Co., Inc.

(116) Rigid Steel Conduit. Bulletin 360-C describes properties and laboratory tests of new silver-gray Dualcote conduit. Walker Bros.

(117) Time Switches. Wiring diagrams for control of heating, lighting, ventilating, and air conditioning equipment are featured in Bulletin 72 on new 7-day time switches. Tork Time Controls, Inc.

(118) Bending Conduit. New illustrated folder covers calculating leg lengths, locating the bend, the back-to-back method, the back-to-back push-through method, and offset bends. Bulletin 260. Lidseen of North Carolina, Inc.

(119) Infrared Ovens using T-3 quartz lamps, quartz tubes or metal rods as the source of heat are detailed in Bulletin 59-240, 8 pages. Fostoria Corp.

(120) Hospital Lights. 8-page Bulletin 144 pictures and describes complete line of adjustable hinged wall lamps and brackets for bedside use. Swivelier Co., Inc.

(121) Fastening Tools. Catalog B-141 contains technical data and illustrations of powder-actuated fastening tools and accessories, plus information on Shure-Set hammer-in fastening method. Ramset Fastening System.

(122) Luminous Tube Transformers of weatherproof and shockproof design are described in 4-page technical bulletin. Jefferson Electric Co.

(123) Silicones and their uses. New 16-page brochure reviews adhesives, laminating resins, rubber compounds, electrical insulation, water repellents, and many others. Bulletin 1-115. Dow Corning Corp.

(124) Generator Brushes. Bulletin EB-100 illustrates and describes how coated Equaload brush reduces commutator wear and threading. Hanson-Van Winkle-Munning Co.

(125) Transformers. 4-page brochure illustrates variety of transformers available, both liquid-filled and dry types, ranging from 10 kva to 10,000 kva. Federal Pacific Electric Co.

(126) Battery Chargers. Bulletin 237 covers complete line of automatic and non-automatic chargers for industrial starting batteries. Automatic Switch Co.

(127) Underfloor Distribution. Engineering data essential for laying out underfloor raceway is given in new Bulletin 515, including dimensioned detail drawings of principal components of the system. National Supply Co.

(128) Distribution Transformers. Catalog 5A2-BL01 includes basic definitions and explanations of transformer terminology plus a full listing of available units from $\frac{1}{10}$ to 167 kva single phase and 3 to 500 kva 3-phase. Acme Electric Corp.

(129) Voltage Regulator, magnetic amplifier type, for ac generators or generator exciters. Bulletin 3300, 14 pages, gives complete data. Fidelity Instrument Corp.

(130) Slotted Angle for construction of shop equipment is covered in new catalog. Globe Co.

(131) Raceway for use on cellular steel deck or in concrete floors. Descriptive copy and sizes are given in Bulletin TD-160-1. Walker Bros.

(132) Motor Starters for air conditioning applications. Bulletin 8630, 8 pages, describes full-voltage, reduced-voltage, auto-transformer, and wye-delta starters rated from 208 to 4900 volts. Square D Co., EC&M Div.

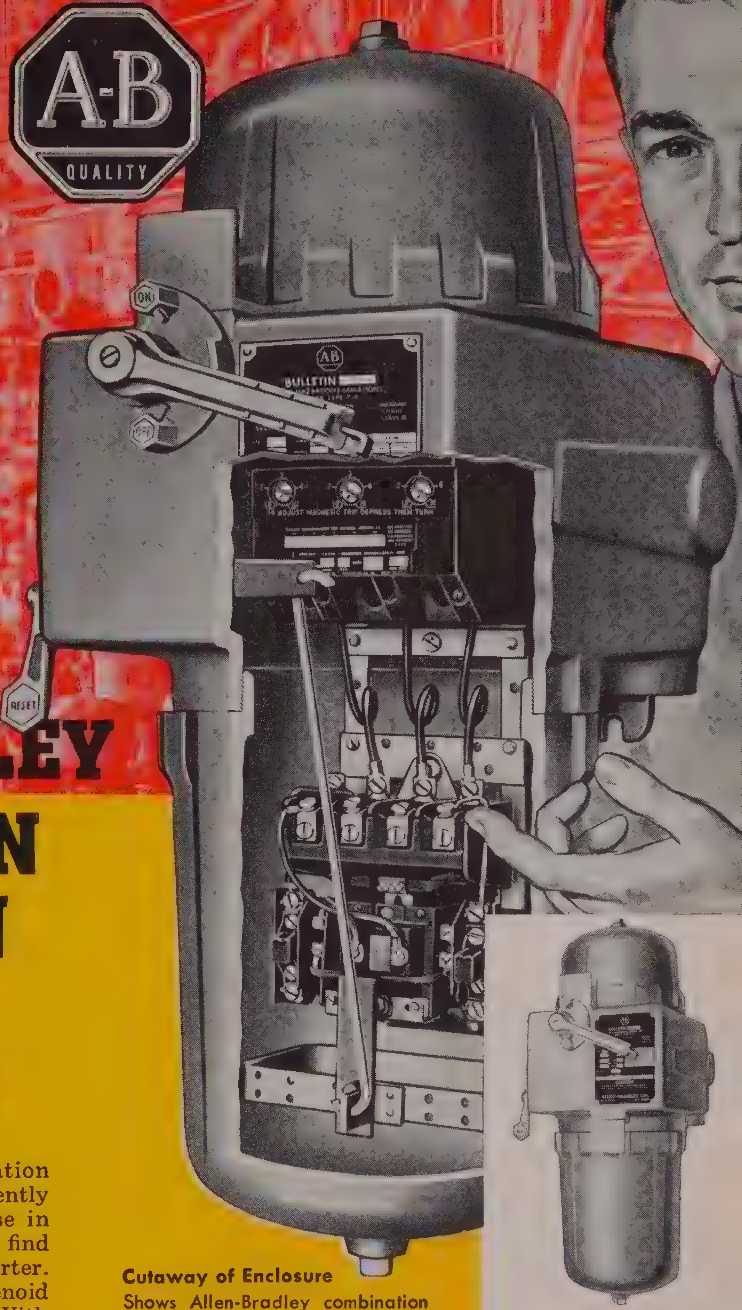
(133) Joint Compound for aluminum bus conductors. 6-page report gives results of laboratory evaluation. Aluminum Co. of America.

(134) Instruments for all types of electrical testing requirements in industry are illustrated and described in 12-page Bulletin 19-60. James G. Biddle Co.

For hazardous locations...

Specify

ALLEN-BRADLEY COMBINATION STARTERS IN SPIN-TYPE ENCLOSURES



Cutaway of Enclosure
Shows Allen-Bradley combination starter. Screw-type cover and base permit quick access to the starter or the circuit breaker.

A-B Bulletin 713
Combination Starter

Here's Allen-Bradley's Bulletin 713 combination starter with circuit breaker—featuring conveniently removable spin-type cover and base—for use in hazardous gas and dust locations. Inside you'll find the time-tested A-B Bulletin 709 solenoid starter.

The consistent reliability of Allen-Bradley solenoid starters is a result of their design simplicity. With only ONE moving part, there's virtually nothing to go wrong—this is your assurance of millions of trouble free operations. In addition, the double break, silver alloy contacts are *always* in perfect operating condition—and remain so with *no* service attention. Also, all A-B starters have two permanently accurate thermal relays that protect motors against dangerous overloads. The reliability of these relays is not affected by atmospheric conditions.

To insure maximum production with minimum maintenance, always insist on Allen-Bradley *quality* motor control. Please write for full information.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
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NEMA 4
Watertight
Weatherproof

NEMA 7
Hazardous
Gas Locations

NEMA 8
Corrosive
Hazardous Gas

NEMA 9
Hazardous
Dust Locations

These enclosures remain available. Because of the trouble free operation of Allen-Bradley control, bolted covers are not a problem.

ALLEN-BRADLEY
Member of NEMA

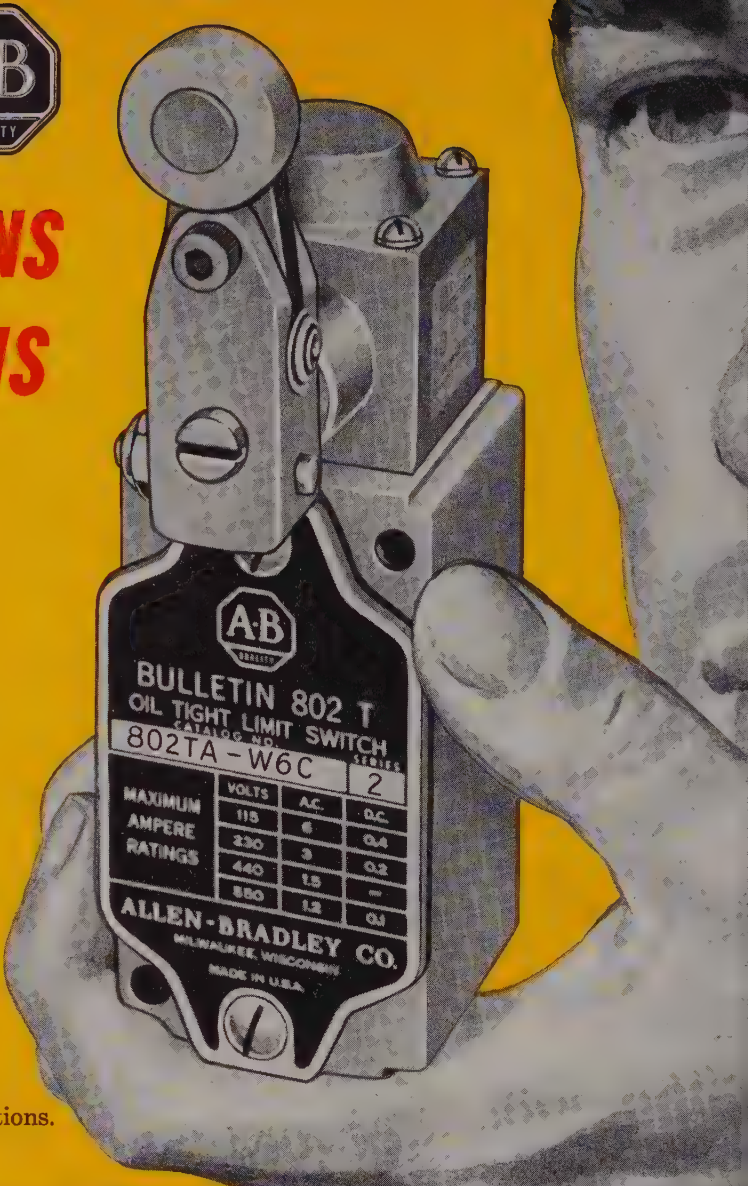
Quality Motor Control

MORE MILLIONS OF OPERATIONS

with Allen-Bradley Limit Switches

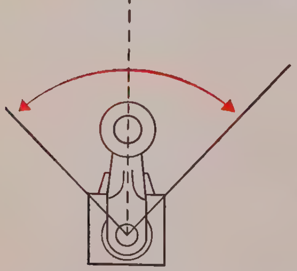
There's nothing now on the market to match the reliability and trouble free performance of Allen-Bradley Bulletin 802T limit switches. They are completely oiltight—operating heads and switch bodies are sealed against oils, coolants, and metal chips. Operators cannot become sluggish or "stick" in operation—contacts cannot become fouled. The double break, silver contacts are always in perfect operating condition—and remain so without maintenance.

Insist on Allen-Bradley—the *quality* line of limit switches that will give you *many more millions* of trouble free operations.

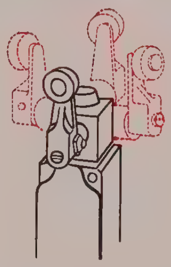


Bulletin 802T Micrometer Adjustment Roller Lever Limit Switch ▲

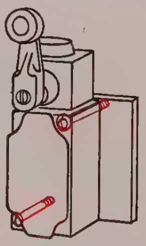
A-B Limit Switch features mean more life, more dependable trouble free service



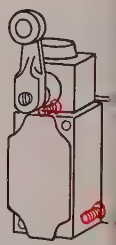
REPETITIVE ACCURACY—Unique toggle blade action assures operation at precisely the same point each time, without adjustment.



FLEXIBILITY—All operating heads can be rotated and fastened in any of four positions 90° apart.



FRONT MOUNTING



REAR MOUNTIN

All Allen-Bradley Limit Switches can be mount either from the front . . . or from the rear.

9-60-RM

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Lifting Magnets

QUESTION T37—I would like to know if any reader has had experience with a crane for loading scrap iron with an electromagnet. The magnet does not release the material fast enough and there is a considerable arc from the contacts. Would this be caused by the field discharge resistor failing to operate? I would like to see a wiring diagram of the entire electrical system including the starter itself. This crane is driven by a gasoline engine.—E.T.

ANSWER TO T37—Your problem is the sum of several electrical conditions listed as follows, then described in order.

(1) The magnet stores energy due to being inductive.

(2) Release of the load governed by magnetic remanence in iron.

(3) Arcing at the contacts.

(1) The energy stored in the magnetic circuit is similar to the energy stored in a rotating flywheel after the driving force has been removed. This energy is expressed in watt-sec. and is the product of $\frac{1}{2}$ the circuit inductance times the circuit current squared—watt-sec. $= \frac{1}{2} L I^2$. When this inductive circuit is opened the initial current in decreasing to zero causes a flux to be set up, which induces a current that tends to keep the current flowing. Also generated is a voltage. This voltage is maximum when the time $t = 0$. The induced voltage can be dangerously high and can puncture insulation if it isn't absorbed quickly.

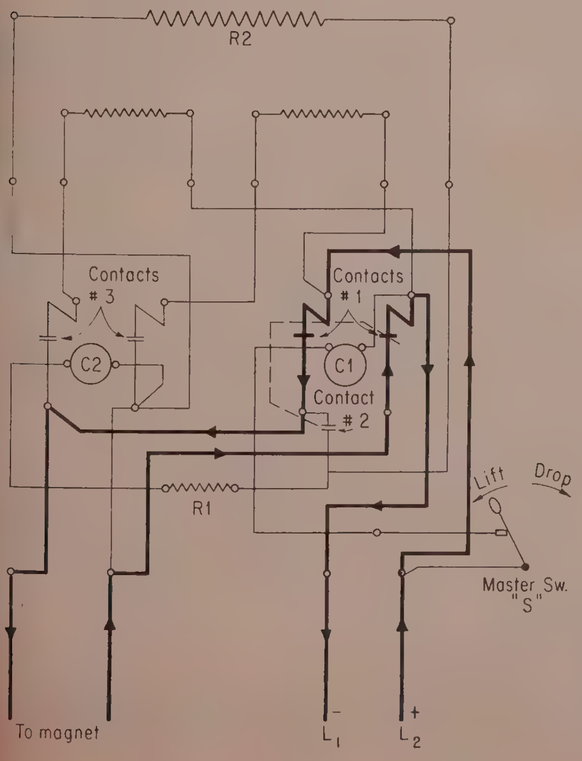
The law of the conservation of energy is obeyed when the energy of magnet is absorbed by the field discharge resistor (and-or) the arc at the contacts, being of course in the form of heat.

(2) The time element involved in the release of scrap iron from the magnet is due to two things: (a) the time for the current to reach zero when the magnet is deenergized, and (b) the remanence of magnetic flux in the magnet core. Since the magnet retains some of the flux after the current reaches zero it must be removed. This is accomplished by sending a current through the magnet in the reverse direction, thus driving the magnet core magnetically to zero. This reverse surge of current will cause the magnet to drop its load almost immediately; whereas, otherwise, it may take up to 15 or 20 seconds.

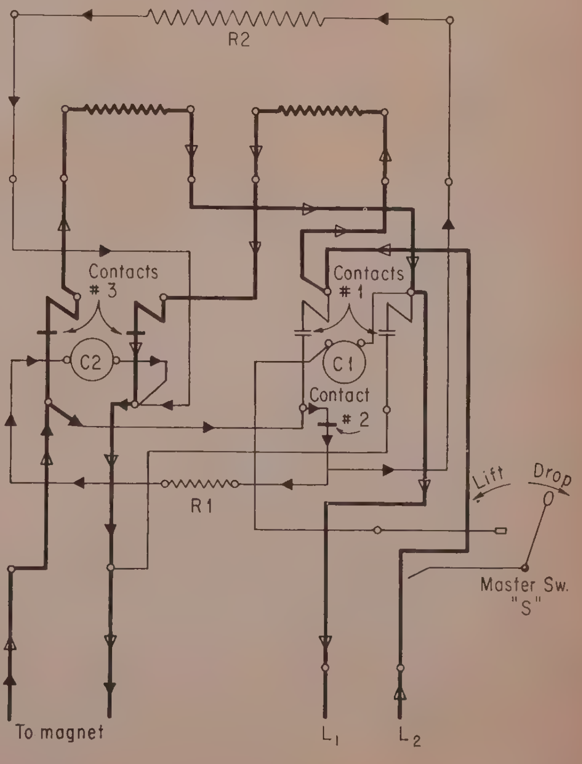
(3) Arcing at the contacts: The contacts of a magnet controller can be protected to a large extent from arcs by employing blow-out coils or two or more contacts in series to brake the arc, in conjunction with the field discharge resistor.

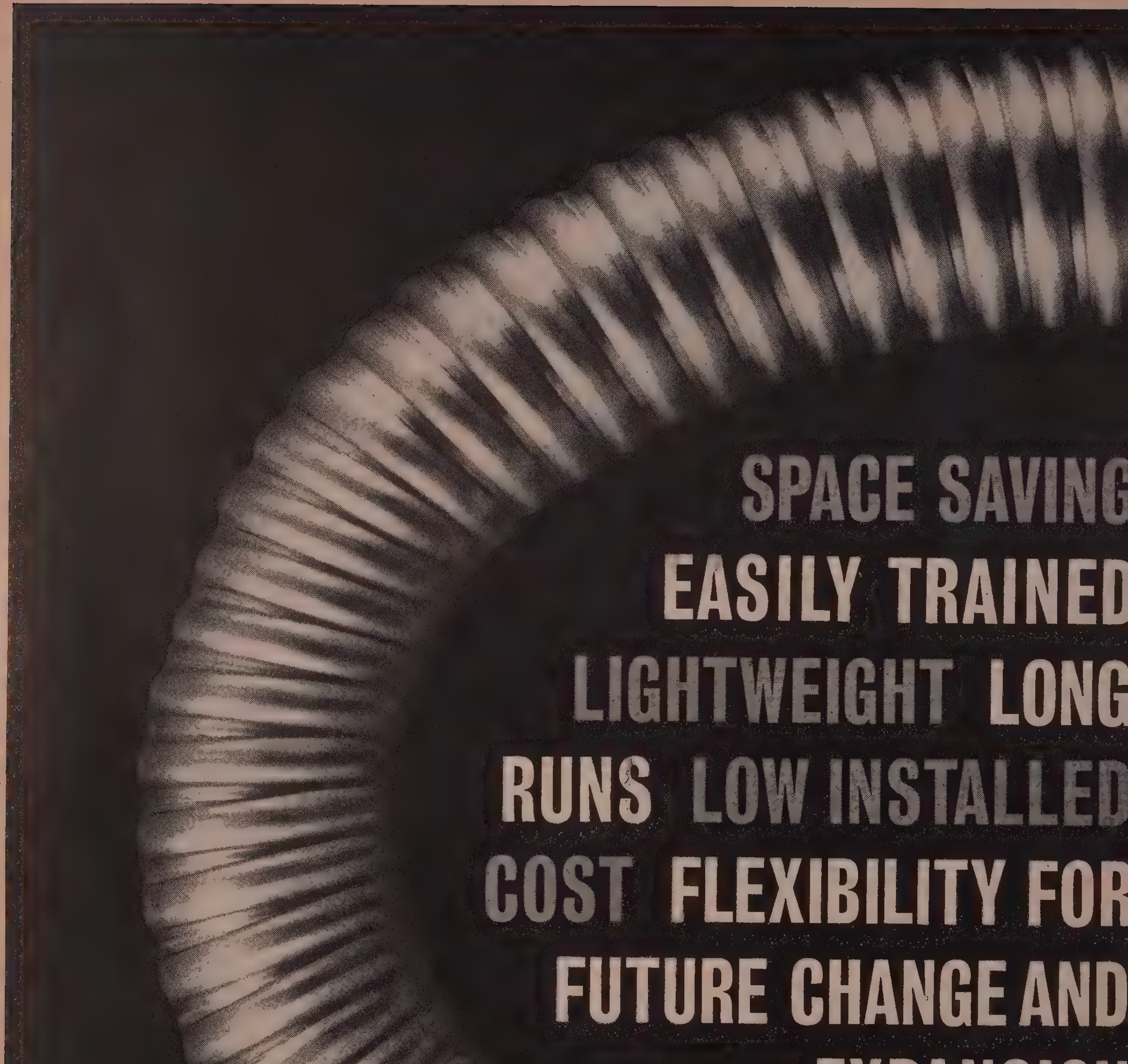
Part of the energy stored in the inductive circuit is dissipated in heat in the arc and in heat in the resistor. The function of the blow-out coil is to set up a transverse magnetic field to the arc. This field acts on the arc as a magnetic field would act on a current carrying conductor. It forces the arc out of the field causing it to assume a longer path. The increased length of the arc increases its resistance, in turn decreasing the current; also this increased length cools the arc.

LIFTING LOAD



DROPPING LOAD




SPACE SAVING
EASILY TRAINED
LIGHTWEIGHT LONG
RUNS LOW INSTALLED
COST FLEXIBILITY FOR
FUTURE CHANGE AND
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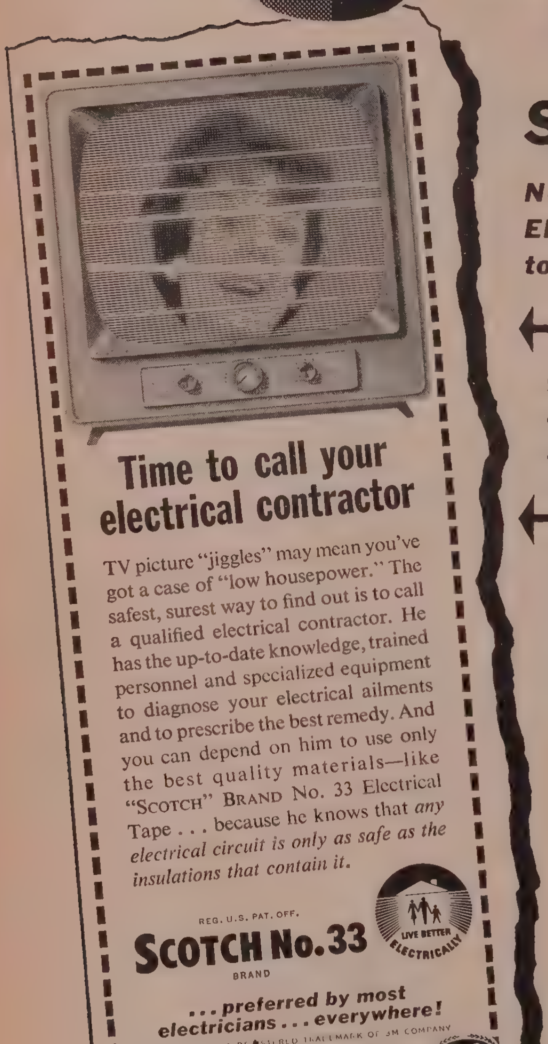
GENERAL CABLE

INTERLOCKED ARMORED CABLE

For full protection under all conditions install General Cable Interlocked Armor...the cable for power, control, communication and lighting systems. This compact, versatile cable is available in a wide range of constructions, insulations, armors and voltage ratings. Colored polyvinyl chloride jacket over the armor can be furnished where required. "How to Obtain the Greatest Advantage Per $ Spent" a comprehensive folder detailing General Cable's complete line of Interlocked Armored Cables is available upon request. **General Cable Corporation**, 730 Third Avenue, New York 17, New York. Offices and Distributing Centers Coast-to-Coast.

NOW!

OPERATION SUPPORT



Time to call your electrical contractor

TV picture "jiggles" may mean you've got a case of "low housepower." The safest, surest way to find out is to call a qualified electrical contractor. He has the up-to-date knowledge, trained personnel and specialized equipment to diagnose your electrical ailments and to prescribe the best remedy. And you can depend on him to use only the best quality materials—like "SCOTCH" BRAND No. 33 Electrical Tape . . . because he knows that *any electrical circuit is only as safe as the insulations that contain it.*

REG. U.S. PAT. OFF.
SCOTCH No. 33
BRAND

. . . preferred by most electricians . . . everywhere!

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M COMPANY
M[illegible] M[illegible] AND MANUFACTURING COMPANY
[illegible] CO. [illegible]960

OVER
23,000,000
readers are exposed to each of these "SCOTCH" No. 33 ads in THE SATURDAY EVENING POST!

Sparking sales for you

Now . . . 3M — makers of SCOTCH BRAND No. 33 Electrical Tape — sponsors a new promotion to support you . . . the electrical contractor!

STRONG ADS LIKE THIS which build business, confidence and public goodwill for you . . . are now appearing in THE SATURDAY EVENING POST!

Now 3M not only gives you "SCOTCH" BRAND No. 33—the top all-around plastic electrical tape—they also give you business building advertising support! These ads, on a regularly scheduled basis, are appearing now in the leading opinion-making magazine—*The Saturday Evening Post*—reaching your best prospects for wiring and rewiring jobs among householders and business and industrial management. Each ad supports you directly as the man to see for the best wiring job for any purpose. Watch for these ads in *The Saturday Evening Post!*

REG. U. S. PAT. OFF.
SCOTCH NO. 33
BRAND

. . . preferred by most electricians . . . everywhere

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK. CANADA: LONDON, ONTARIO.

Electrical Products Division | MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW

Your question asks about a discharge resistor failing to operate. If it were open the arc would be tremendous, its length would be too great for a blow-out coil to break. Possibly it would be to your advantage to install a discharge resistor having a value equal to the combined resistance of the magnet and its rheostat if one is used. Accompanying drawings show a typical magnet controller and its sequence of operation.

This controller provides rapid magnetization and demagnetization of the lifting magnet. To lift a load the master switch S is moved to the *lift* position. This energizes coil "C_1" which closes contacts No. 1 and connects the magnet across the line. The master switch remains in this position while the load is being lifted.

At the time you wish to drop the load, the master switch is opened. Contacts No. 1 open and contacts No. 2 close connecting coil "C_2" across the terminals of the magnet, through contacts No. 3. Now a reverse voltage flows to the magnet. With resistor R_1 in series and R_2 in parallel with coil "C_2," which is energized by the voltage due to decaying flux in the lifting magnet for a few seconds. This time can be regulated within certain limits by varying resistors R_1 and R_2. The reversed current flowing in the coil of the magnet for a few seconds neutralizes the residual magnetism (remanence in the iron) 1 to 3 seconds for a drop with reverse voltage as compared to 15 or 20 seconds without reverse voltage. A lot more scrap iron can be moved in the same period of time.—F.N.S.

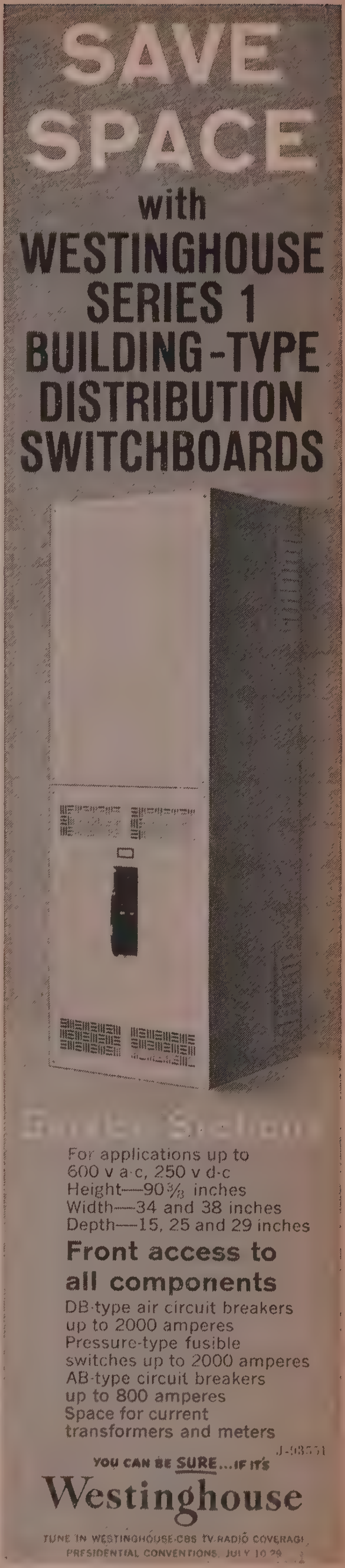
ANSWER TO T37—The field discharge resistor is used to bring the voltage between the magnet coil leads at the time when we open the circuit to about twice the operating voltage instead of to about 100 or more times the operating voltage if conditions are O.K. The field discharge resistor will reduce the arc, but to release the load we reverse the dc polarity. A double pole double throw center off starter with the resistor close to the coil is all that we need.—H.S.

Grounding Control Circuits

QUESTION U37—We are in the throes of changing our control circuit voltage from 440 to 110. This will be accomplished by the use of single-phase transformers. Our power distribution system consists of both the star (grounded 4-wire) and delta (ungrounded 3-wire) in separate areas, of course. The question is whether to ground the secondary side (110 volts) of the control circuit transformer. Further, will there be any undesirable effects of either method on either system and finally, which is preferred?—J.A.M.

ANSWER TO U37—Every ungrounded system can become a grounded system during a breakdown. If we ground the line going to coil, then a second ground will blow a fuse but will not start a motor. With an ungrounded system, one ground on each side of the overload heaters will let the motor work under dangerous conditions. On both sides of the start contacts, the two grounds can permit a steam boiler or other items to operate in a dangerous condition.—H.S.

ANSWER TO U37—The questions involve compliance with the NEC and other practical considerations to afford the safe operation of control circuits. Since the control circuits are 110 volts, they are undoubtedly Class 1 circuits (or better) as defined in Article 725 of the NEC. Sections 725-21 and 250-8 require the grounding of control circuits where the primary supply voltage exceeds 150 volts to ground. This applies in this instance, because the supply voltage is 480 volts, and whether this supply is grounded or ungrounded, it would be classified over 150 volts according to the definition of "Voltage to Ground" in Article 100 of the NEC. I have included four sketches, which point out the possible methods of grounding and arranging control circuits, and what can happen with each method. Fig. 1 shows a typical control circuit arrangement found in most magnetic starters. Here the secondary circuit is grounded to comply with the NEC; but due to the arrangement of control devices, a possible ground between one side of the holding coil and the last OL relay will shunt out the OL's, and they will not open the control circuit in the event of a motor overload. Fig. 2 shows the same arrangement, except the OL relay connections have been shifted to the other side of the holding coil in series with the other control devices. The grounded secondary leg is run directly to one side of the holding coil, and thus, any accidental ground will not cancel out any of the control devices. While this arrangement is not specifically



For applications up to
600 v a-c, 250 v d-c
Height—90⅜ inches
Width—34 and 38 inches
Depth—15, 25 and 29 inches

Front access to all components

DB-type air circuit breakers up to 2000 amperes
Pressure-type fusible switches up to 2000 amperes
AB-type circuit breakers up to 800 amperes
Space for current transformers and meters

J-03551

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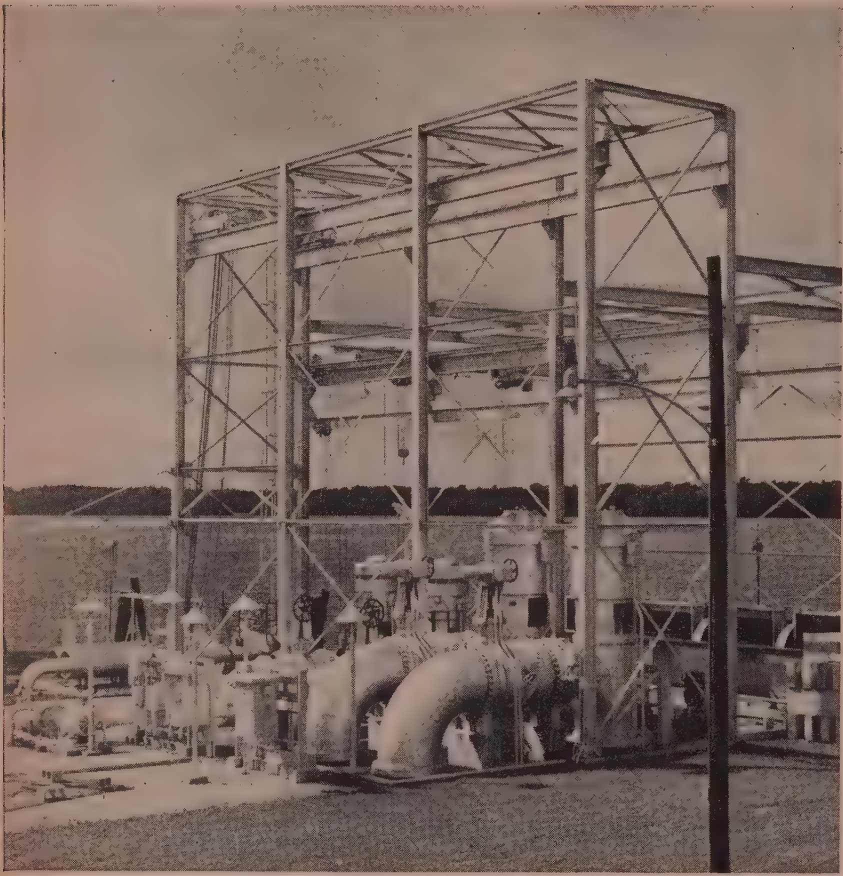
News about

B.F.Goodrich Chemical *raw materials*



Florida Power & Light Company uses anode racks made of Geon vinyl pipe. Fabricated by F P & L plant personnel at this job. B.F.Goodrich Chemical Company supplies the rigid Geon vinyl. These photos show intake structure at Palatka plant on St. John River, one of many places anode racks of Geon are used.

FP&L fights underwater corrosion with anode racks of rigid GEON

Underwater steel structures corrode when they are attacked by galvanic currents. Florida Power & Light engineers solve the problem two ways. They reduce effect of galvanic currents with an opposing voltage and they suspend anodes of graphite to bear the brunt of any continuing flow. These anodes rest in frames made of rigid Geon pipe.

Vertical side frames are 2″ Geon pipe and trays are open sections of 5″ pipe. The only effect on the racks of Geon is the marine growth shown in the photo at upper right. This growth is easily washed off, as photo at lower right shows.

Here's another example of the way Geon vinyl can solve corrosion problems for utilities. As pipe, as conduit, or as coatings, you'll find Geon vinyl is often the answer to your corrosion problems. For more information, write Dept. GX-4, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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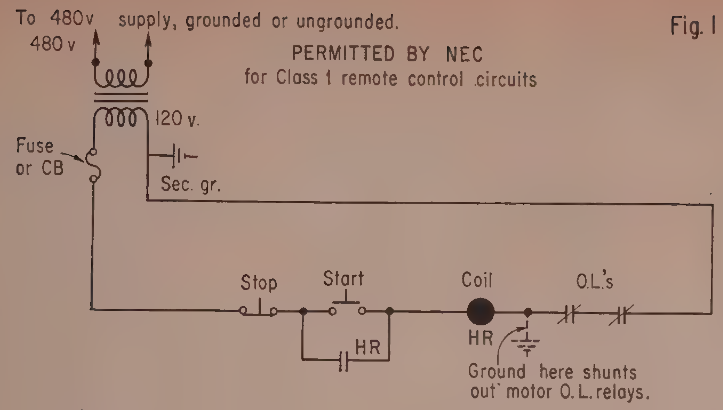
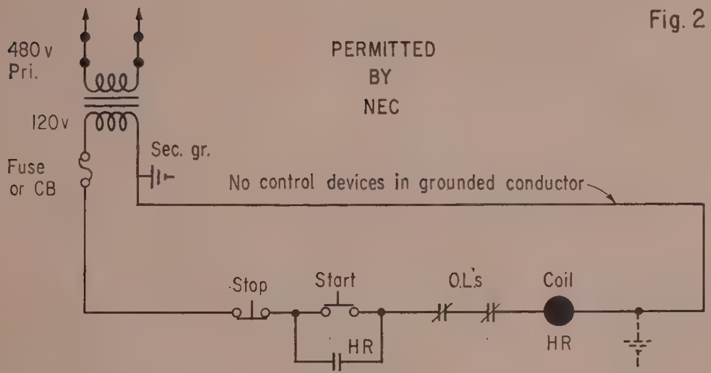
Fig. 1



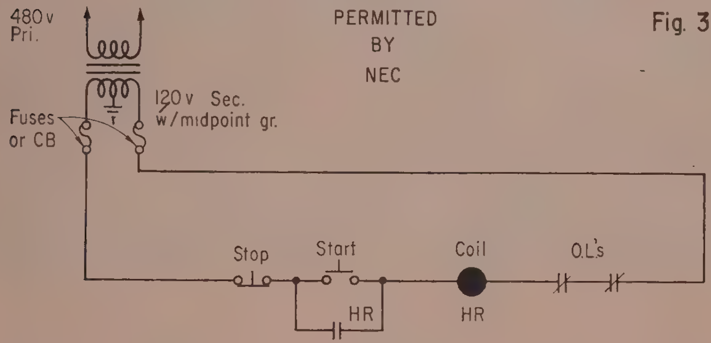
To 480v supply, grounded or ungrounded.
480 v
PERMITTED BY NEC
for Class 1 remote control circuits
120 v.
Fuse or CB
Sec. gr.
Stop
Start
Coil
O.L.'s
HR
HR
Ground here shunts out motor O.L. relays.

Fig. 2



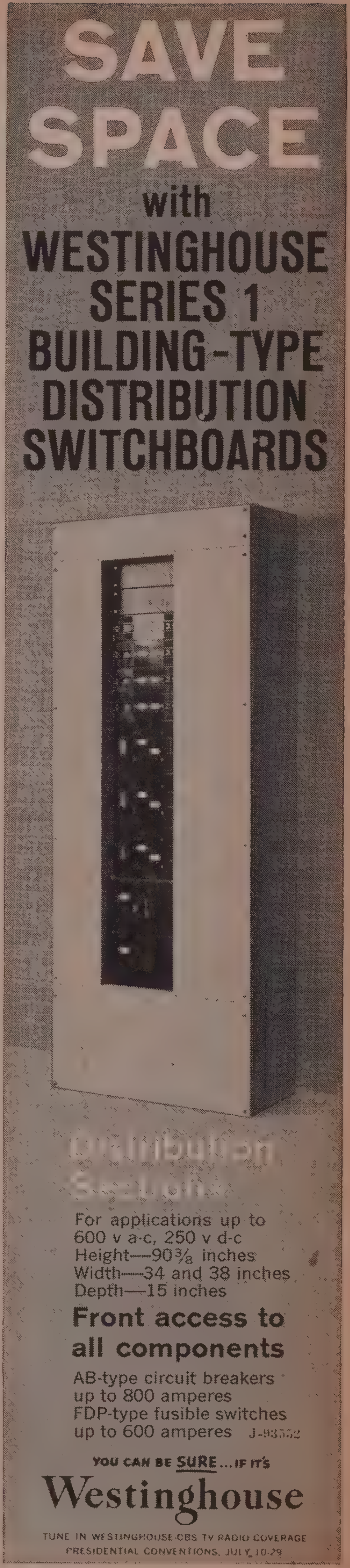
Additional ground will not effect operation of control devices.

Fig. 3



Any ground that appears on load side of fuses or CB will open control circuit.

required by the NEC, it offers a maximum protection for equipment controlled by the various control devices. And it is the most economical method of accomplishing such control arrangements, as connections in the magnetic starter can be readily changed. Fig. 3 shows another possible method of providing maximum protection. The control devices are arranged as shown in Fig. 1 (standard hookup), but a special 480/120 transformer is used that has a midpoint connection, and the midpoint is grounded. Therefore, the secondary voltage to ground on each ungrounded conductor is 60 volts. Any ground that would appear on the control circuit would open one of the overcurrent devices and disconnect the control circuit. Another feature of this system is that the 60 volts to ground reduces the shock hazard somewhat, while still providing a 120-volt line supply. However, such transformers with a mid-point ground for a 120-volt secondary are not readily available, and the cost may be considerably higher than the one shown in Fig. 1. If only one control transformer is involved for the supply of all the control circuits, the cost could be justified. This method is used in many instances where the control circuits are 240 volts, as 480- to 120/240-volt transformers are standard, and midpoint grounding on the secondary winding is very simple. Finally, Fig. 4 shows the arrangement of a control circuit the same as in Fig. 1, except that



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For applications up to
600 v a-c, 250 v d-c
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Width—34 and 38 inches
Depth—15 inches

Front access to all components

AB-type circuit breakers
up to 800 amperes
FDP-type fusible switches
up to 600 amperes J-93552

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Westinghouse

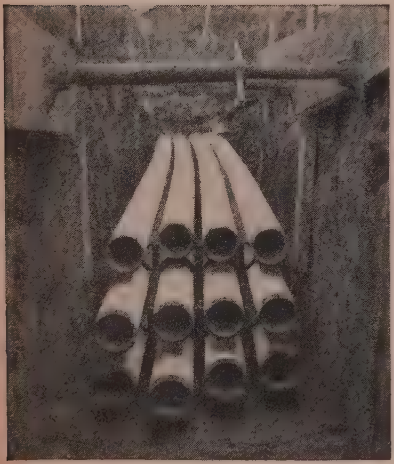
TUNE IN WESTINGHOUSE-CBS TV RADIO COVERAGE
PRESIDENTIAL CONVENTIONS, JULY 10-29

Get peak cable protection **at lowest dollar cost**

Transite Ducts can be laid directly in trench without concrete envelope. Or if ductbank is to be concrete enclosed—thinner walled Transite Duct may be used. In all other respects both heavy-wall and thin-wall Transite Ducts are identical.

Transite Ducts save on the job and after!

No other duct material gives you so many installation and in-service economies



In every way, Transite® Ducts are the most efficient electrical ducts you can install. And—when assembled with J-M's Plastic Coupling—their cost is remarkably low!

One reason for this economy is in installation. Strong, lightweight, long —Transite lengths are easy to handle and install . . . Your men set the ducts in place easily, join them tightly in seconds. Transite's smooth bore is free of burrs and obstructions. Thus, long cable pulls are easily accomplished with no damage to cable sheathing.

You see another reason for Transite's economy in performance. Once in service, Transite's unusually high rate of heat dissipation means cables run cooler, last longer. Transite also confines arc damage . . . cannot burn, smoke or fume. It won't generate explosive or toxic gases. If arcing does occur, Transite Ducts won't sag or adhere to cable.

Let us send the Transite Duct brochure EL-29A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JOHNS-MANVILLE JM PRODUCTS

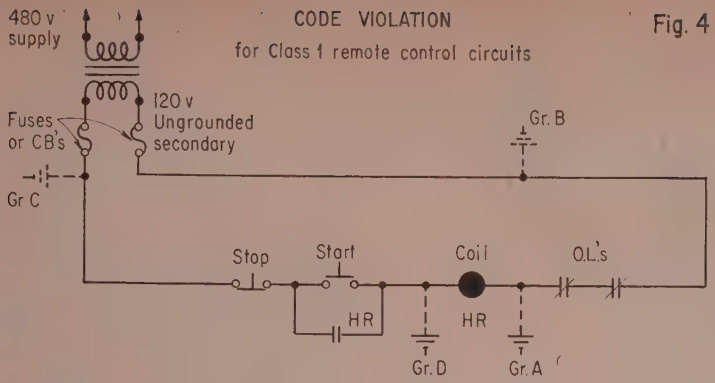


Fig. 4

CODE VIOLATION for Class 1 remote control circuits

the 120-volt secondary is ungrounded. Many possible sources of trouble could occur here. Ground A could occur without opening the overcurrent device or shunting out the overload relays. But if ground B occurs later, the OL relays will not open the circuit. On the other hand, remove grounds A and B, and see what can happen if grounds C and D occur. Suppose ground C appears. Again, no overcurrent device will open, nor will any control device fail to operate. But if ground D occurs, the magnetic starter will be in operation, and the stop button could not disconnect the control circuit. Or ground D could occur after the motor started, and again, the stop button could not disconnect the motor. This could be a very serious hazard with many types of equipment, and grounds do appear commonly in control circuits due to the use of smaller conductors with less insulation. As a result of the foregoing, I recommend the use of the control circuit arrangements shown in Figs. 2 or 3, and know they will offer maximum protection of equipment.—J.H.W.

Bake Oven Design

QUESTION V37—Can anybody tell us how to build a bake and burnout oven large enough to take a 100-hp motor? We have 220-volt, 3-phase power available.—O.H.

ANSWER TO V37—About five years ago, my predecessor built a bake oven. Well, my first act when I took over was to scrap this "home made" oven and purchase one to handle motors up to 100 hp.

There was one primary consideration that predicated this move; i.e., better results from the rewind shop. The success or failure of any rewind hinges upon the protection afforded by the varnish. The degree of success is contingent upon the thermal setting properties of this varnish. Therefore, baking temperature and time are of utmost importance. Well, we found that our "home made" oven, though well made, did not provide the necessary and adequate control.

For your information, we purchased our oven from Young Brothers Co., Cleveland 13, Ohio, a 14,400 watt cabinet type oven, and we are completely satisfied.—J.A.M.

Frequency Changers

QUESTION W37—Is there any practical method of raising the frequency by means of electronic tubes for power purposes?—E.B.

ANSWER TO W37—Certainly, there are several types of conversion units available for producing high-frequency power by means of electronic tubes. In some of these systems, the ratio of the input frequency to the output frequency is rigid, whereas in others one or both frequencies may vary over wide limits.

These employ vacuum-tube oscillators, ignitrons, water-cooled pliotrons, mercury-arc converters or combinations of these. There are numerous high-frequency commercial units available, but as a precaution, these should be purchased for the specific needs.—J.A.M.

ANSWER TO W37—When we talk about raising frequencies for power purposes, this implies currents of larger capacities. Basically, high-frequency power circuits in use today are for high-frequency induction heating (360 to 10,000 cycles), high-speed power tools (120 cycles), and high-frequency lighting (400 cycles). In these three instances, motor-generator sets, frequency converters, or magnetic frequency multipliers (static converters) have proven to be the most economical means to raising frequencies for power purposes to date. Motor-generators have an upper limit of about 15 kc.—J.W.

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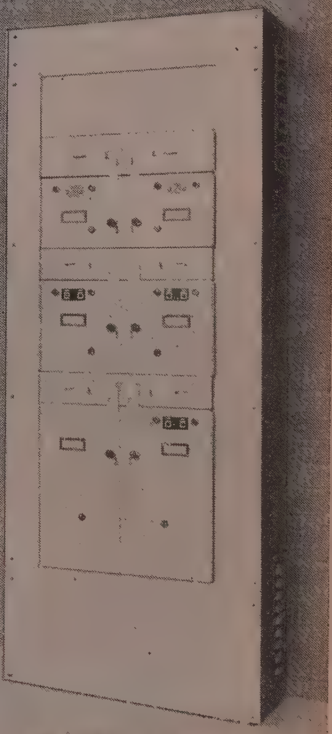

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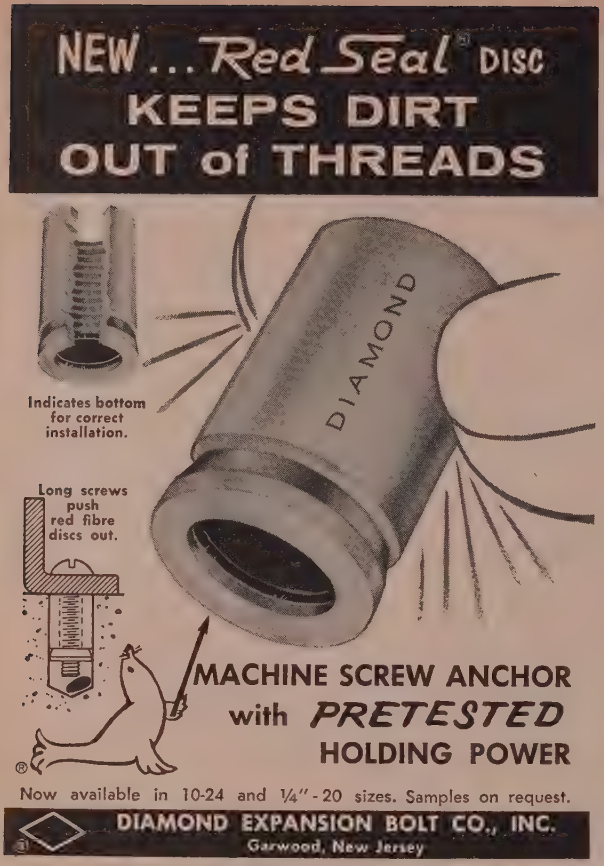
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QUESTION E38 — Our two IBM 604 data processing machines have been making errors which we feel are due to the power supply. The 220-volt single phase service for the machines are taken from a 3-phase, 220-volt ungrounded delta substation. An oscilloscope placed across the input to the IBM machines shows occasional spikes of very short duration and 50 volts or more in magnitude. We have been unable to locate the source of this "noise" because of its infrequent nature. I would be interested in knowing what other readers have been using for data processing machine supplies, and also whether or not a band pass or low pass filter network would work for this application. If so, how would you design the parameters?—I.G.B.

QUESTION F38—In our plant we have a 40 hp, 2300-volt, 3-phase, 60-cycle synchronous motor, excitation 110 volts. This motor drives an ammonia compressor and it has automatic synchronizing equipment.

When we start this equipment, it turns over and has a heavy growl. It accelerates in speed growling and vibrating continuously. In about five minutes after starting, it reaches 92% of synchronous speed and latches in and runs without a growling noise. The air gap is 0.055 and symmetrical throughout. The motor has 0.015 whip.

Can someone tell us what is wrong with this motor?—C.P.

QUESTION G38—I would appreciate the opinion of others as to whether it pays to use "rough-service" lamps on temporary lighting of buildings under construction.

Strings of lights are sometimes moved around, and water often drips on the bulbs. Vibration and wind can also enter into the problem.

Rough-service lamps usually cost at least twice as much, and they are not quite as efficient in the amount of light they give.

I have used both kinds, but still cannot answer the question as to which is the better method.—M.C.T.

PLEASE SEND IN YOUR ANSWERS BY JULY 15

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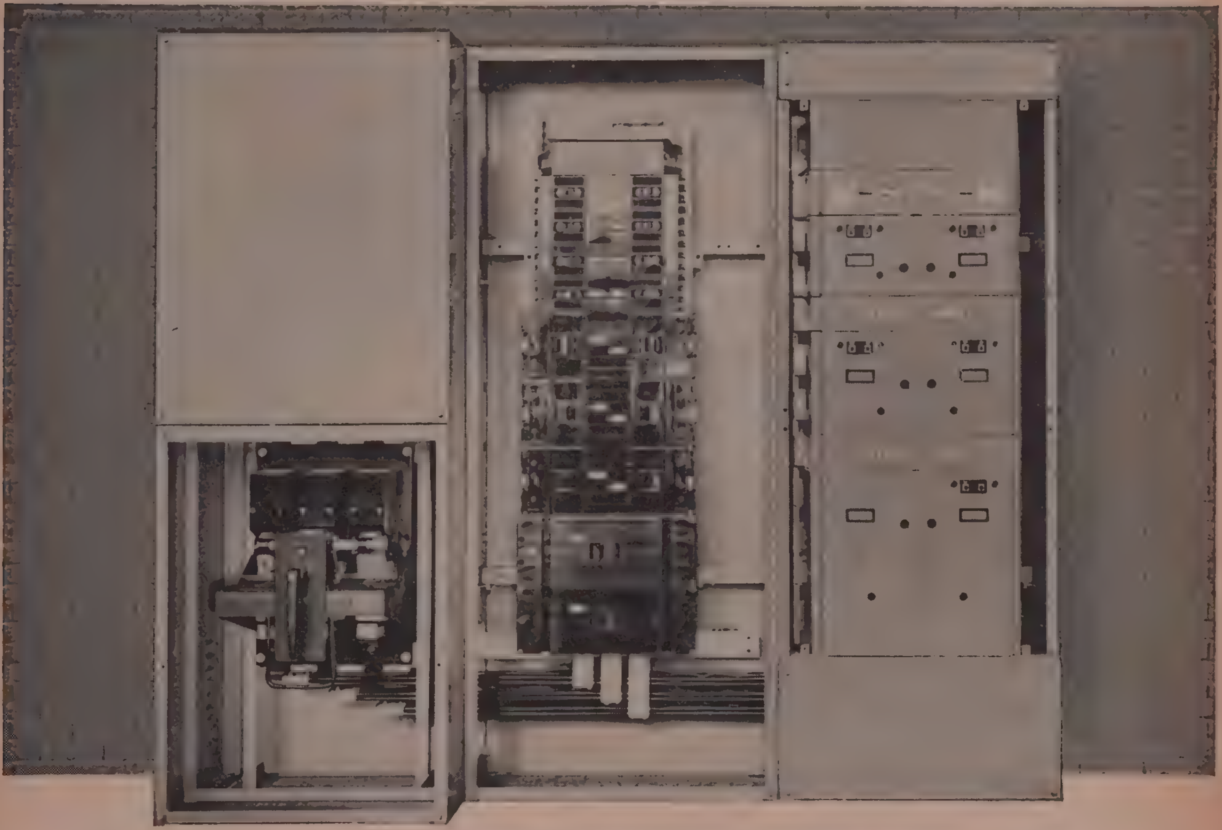

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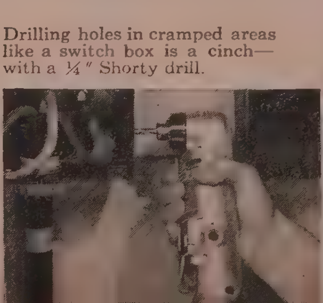

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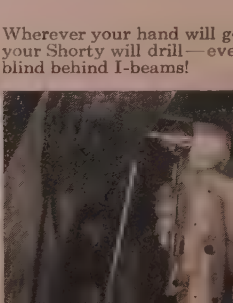

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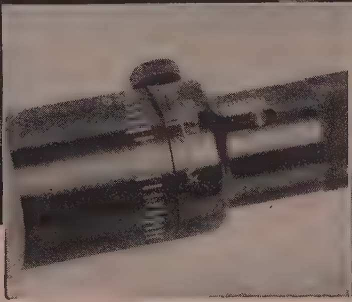
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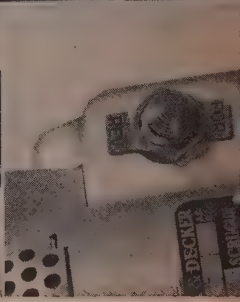
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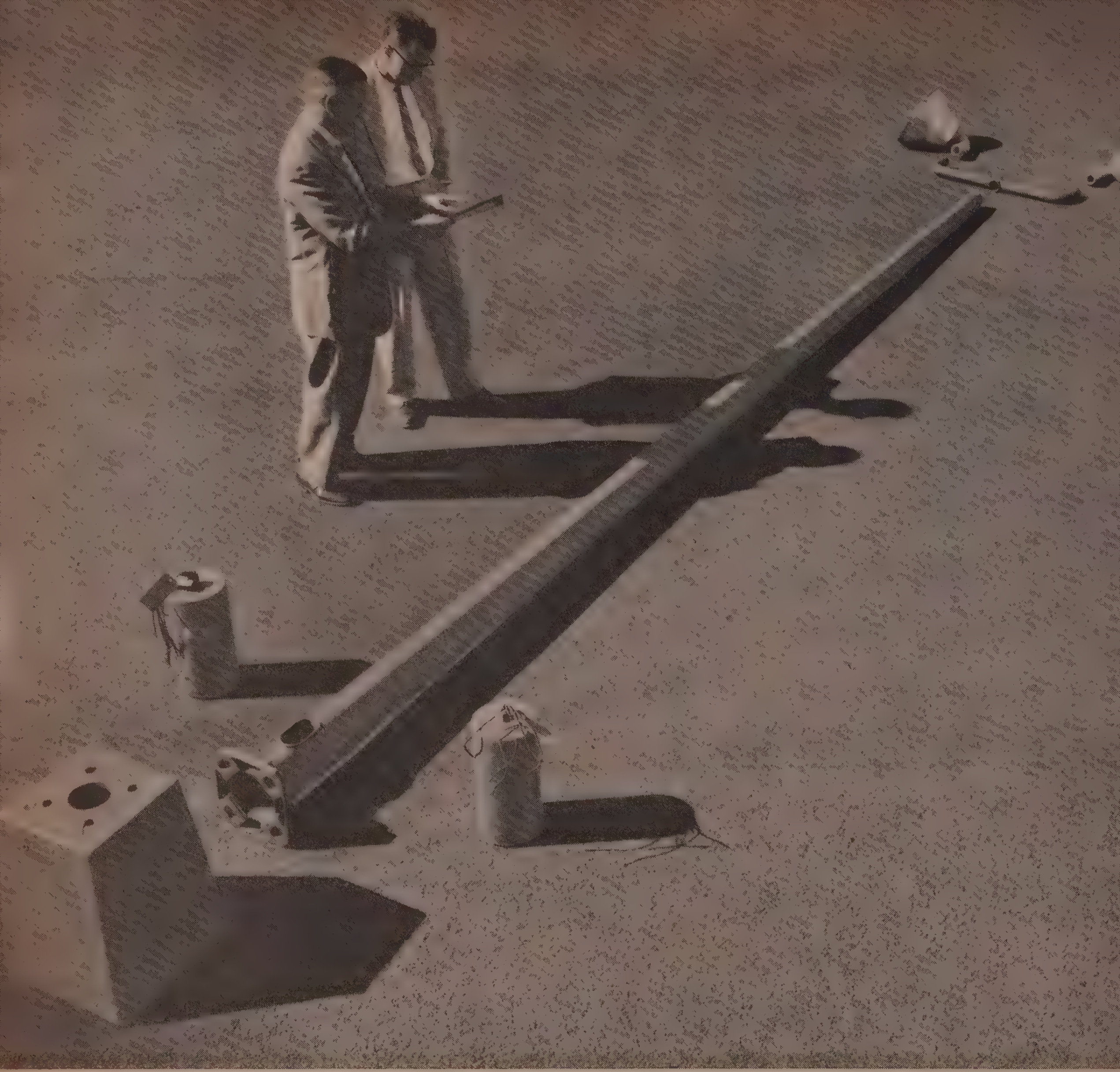

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Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

Panelboard Enclosures Width of Gutters

Q. *Section 373-6 of the 1959 NEC refers to deflection of conductors in cabinets or cutout boxes. If the same rulings apply to lighting panelboards, then there are a few questions in connection with this, and your clarification would be appreciated.*

We have made six sketches shown below, of a standard size 42-circuit, single-phase lighting panel which normally is equipped by the manufacturer with 4-in. gutters. Three 250 MCM cables are used in this particular sample case for feeders. The sketches are numbered from 1 to 6.

1. Conductors enter the cabinet in a horizontal direction and therefore, are not subject to the same rules as a vertical conductor. Therefore, no violation exists.

2. As far as we know, no code violation exists.

3. Vertical conductors are not deflected, and no violation exists.

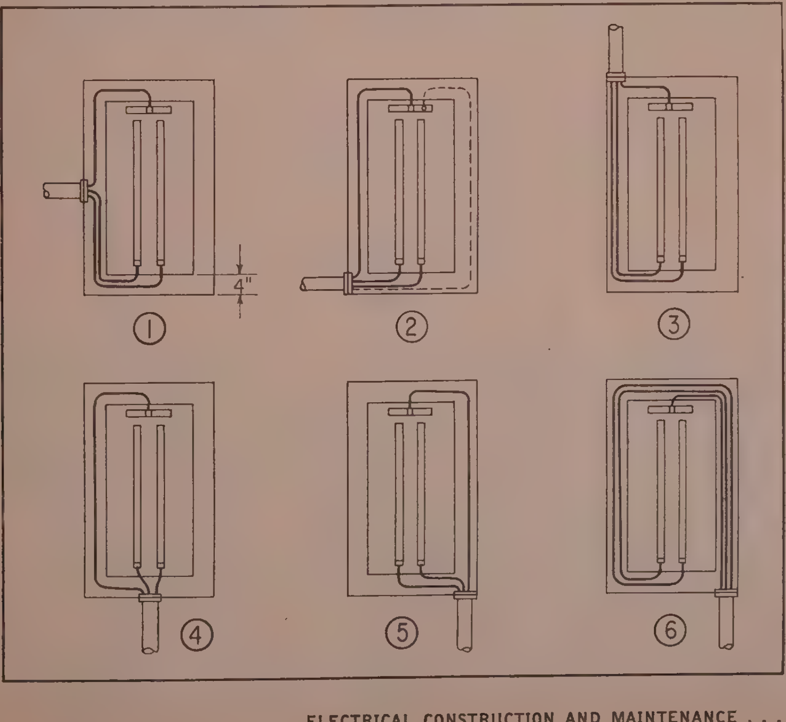
4. Conductors, according to panelboard manufacturers, are fanned out and not deflected. Therefore, again no violation exists.

5. This would be a code violation, and 4½-in. gutters would be required.

6. Again no violation exists.

Please note that in all six cases we have not taken the grounded or neutral conductor into consideration. Again, some panelboard manufacturing companies assure us that this is not necessary. It seems that in some cases the feeder conductors would occupy a considerable amount of space in the panel gutters, and since restrictions are placed upon the number and size of conductors installed in cabinets or cutout boxes only and not in panel gutters, no attention has been paid to this item.

We might mention that panelboards are manufactured in accordance with UL standards on the basis of direct line bottom entry of a wire size equal to the rating of the panelboard bus. Since some of the panelboard companies rate these buses at 225 amps, it would seem that under those conditions an installation as indicated in Fig. No. 4 with 250,000 CM conductors would be acceptable. This would also verify our previous statement in connection with the grounded or neutral conductor.—J.L.



A. The provisions of Section 3736 of the 1956 edition of the NEC first appeared under Section 503-s of the 1928 Code, some 32 years ago. Previous to 1928 the deflection of conductors was recognized as far back as 1923 in a more general manner. Section 373-6 of the 1959 Code has been revised, as covered by Mr. Michener in his analysis of the 1959 revision of the NEC, "to provide additional steps in the table, providing break points at sizes of aluminum as well as copper conductors that are useful in connection with standard ratings of equipment."

It is also significant to note that the 200 MCM conductor has been eliminated apparently on the basis that this size of conductor has not been recognized in the code since 1937. According to the 1956 Code 250 MCM and 350 MCM conductors were required to have a minimum gutter width of 6 in. According to the 1959 Code, such widths have been decreased as follows:

250 MCM-4½-in., 300 MCM-5-in., and the phrase 300,000 to 350,000 CM followed by 400,000 to 500,000 leaves the status of 350,000 questionable. It appears that the word "inclusive" should be inserted, but it also appears that a 350 MCM conductor requires only a 5-in. gutter. The important fact remains that the gutter width for such conductor sizes have been decreased, and in the case of 250 MCM the decrease, 1½ in., is considerable.

Since the CSA of the conductor should be a factor of importance, it is significant to note the dimensions of rubber-insulated conductors (excluding RU) in the 1937 Code compared with the 1959 Code:

	Area		
	1959	1937	1959 RU-T
250,000	.5917	.58	.4877
300,000	.6837	.67	.5581
350,000	.7620	.75	.6291

It is evident that the 1937 dimensions are slightly less than the 1959 dimensions. It is important to note, however, that the small diameter insulations are considerably smaller than the rubber dimensions. The foregoing observations are influenced by the fact that the gutter

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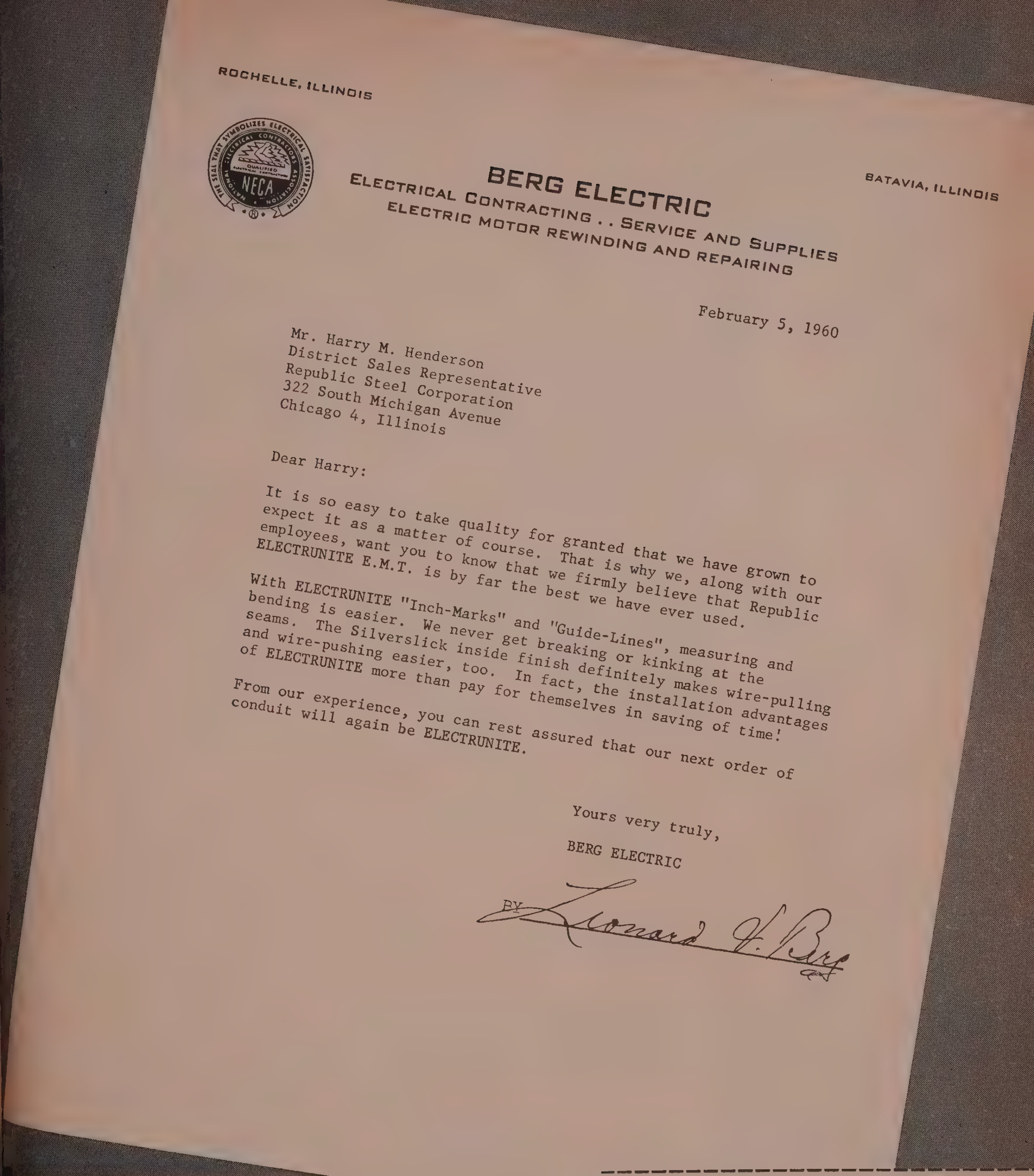

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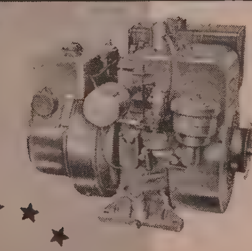

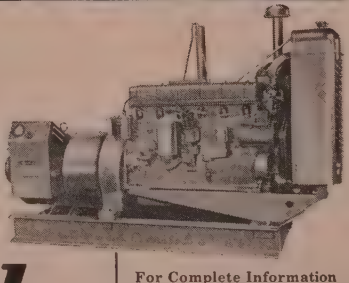

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width for a 250 MCM conductor, which forms the basis for your questions, has been decreased from 6 in. to 4½ in.

The occasion for Section 373-6 is covered by Abbott's NEC Handbook, 1933 edition as follows:

"The purpose of this requirement is to allow the conductors to leave the conduit with a large radius bend. A short bend at this point may jam the conductor against the conduit bushing with considerable force, and this condition may eventually result in a ground."

The same explanation is given in the 1956 edition of Abbott's Handbook. It is important to note in this respect that the provisions of Section 373-6 (b), which require insulation at bushings, tends to satisfy the occasion for gutter width as covered by Abbott back in 1933. At that time there was no code requirement with respect to the use of insulated bushings.

The provisions of Section 373-6 (a) apply to a cabinet or a cutout box which contains a panelboard, and I know of no exception which exempts a lighting panelboard from compliance. There is no distinction in hazard with respect to the type of panelboard used. Conductors of 250 MCM which enter a power panelboard cabinet present the same problem when they enter a lighting panelboard cabinet. My personal opinion with respect to the diagrams submitted are as follows:

1—While the rule concerns only vertical conductors, it appears to me that the code would be quite inconsistent if it did not intend to recognize the situation which is identical to that which prevails when conductors enter horizontally. I would criticize such an installation on the basis of code intent. Is there any good reason why the conduit should not enter the lower gutter as shown by Fig. 2?

2—The provisions of Section 373-6 of the code do not absolve the grounded conductor from compliance. There is no exception as in the case of Section 373-6 (b) covering insulation at bushings. The rule covers all conductors, and why not, may I ask, bring the grounded conductor horizontally over to the right hand gutter, as shown by the dotted lines?

3—Here again the grounded conductor is deflected and a 4½ in. gutter is required.

4—Grounded conductor deflected. Code violation.

5—Code violation unless 4½-in. gutter provided. According to the 1956 Code a 6-in. gutter was required.

AFTER 30 YEARS ON THE JOB . . . Okolite insulation still looks good. This unretouched photograph shows a section of 11.5 Kv power cable recently re-assigned by Duquesne Light Company. Note that the insulation is still flexible and resilient—workable. Tests made this year show the tensile strength has deteriorated very little, remaining more than 33% above the original specification figure.

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6—While a literal reading of Section 373-6 (a) appears to be satisfied, it is my opinion that such an arrangement could be criticized on the basis of Section 373-7 (a) which is quoted as follows:

"Cabinets and cutout boxes shall be selected which have sufficient space to accommodate all conductors installed in them without crowding."

In addition to the space taken by the feeders, we have 42 circuits. On the basis of 2-wire branch circuits we may have as many as 84-No. 12 conductors. I doubt very much if UL anticipated such use when listing a panelboard.

A summary of the foregoing leads one to believe that the original occasion for Section 373-6 (a), as covered by Abbott in 1933, has been satisfied to a considerable degree by the provisions of paragraph (b) which require insulation at bushings. This is particularly true when substantial insulating bushings are used. To me, both the width and the depth of the gutter should be factors of importance when considering the general provisions of Section 373-7 covering "sufficient space to accommodate all conductors installed in them without crowding." An enclosed panelboard labeled by UL covers both the panelboard and the enclosure (cabinet). Such a listed assembly should indicate reasonable compliance with Section 373-7, provided the conditions of use are normal. Otherwise the inspector has the responsibility of interpreting the provisions of this section.—B.A.McD.—6/60/1

Recessed Fixture Installation

Q. *I am installing a recessed fixture in a house and would like an explanation of Section 410-65 (b-2) of the code. If I install a junction box 1 ft from the fixture, and run approved wire for the temperature encountered from the fixture to the junction box, must this wire be 4 ft long?—R.B.*

A. For the convenience of our readers, the provisions of Section 410-65 (b-2), covering Special Provisions for Flush and Recessed Fixtures, read as follows:

"Tap connection conductors having an insulation suitable for the temperature encountered shall be run from the fixture terminal connection to an outlet box placed at least 1 ft from the fixture. Such a

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*A report on rigid steel conduit**

Rigid steel conduit offers found in any type of conduit physical damage t

For more than 50 years, architects, builders, engineers and electrical contractors have protected electrical systems by running wires through steel raceways.

So well known and so certain is this protection that the National Electrical Code includes the use of rigid steel pipe conduit for all applications and locations, both inside and out, and *specifically* requires it in particularly hazardous locations with explosive atmospheres.

The planning of an electrical system. There are several basic steps in the planning of an electrical system; the most important of these being: safety, capacity, voltage regulation, accessibility and flexibility.

The designer himself should have but one objective: *to give the owner an electrical system that operates economically and performs efficiently.*

The original raceway wiring system. The first consideration in any wiring plan? *Safety!* Engineers and architects know from experience that open circuits, short circuits and induced circuits are bound to develop in wiring systems in any one of the following ways: faulty wiring, lightning, sudden shock and overloading.

To combat these hazards, engineers and architects have always turned to the original raceway wiring system—rigid steel pipe conduit. Here are some of the reasons why:

Rigid steel conduit contains the damage; prevents it fro spreading to the plant, home, garage or office.

Rigid steel conduit provides a grounded metallic system induced currents are drained off without danger.

Rigid steel conduit has strength and cannot be damage by moving objects; objects that might break conductors or the insulation of wires that are left unprotected o semi-protected.

Despite the expert knowledge and intelligent planning of the designer, rewiring is quite often necessar before a building becomes obsolete. In this case, th existence of rigid steel conduit simplifies the rewirin problem and contributes much to cost reduction.

The economy of rigid steel conduit. Rigid stee conduit offers a permanent system that will outlas most buildings and provide the capacity for expansio and replacement of conductors when new wiring i needed to meet increasing loads.

In addition, the cost of replacing old circuits wit new and larger wires through the existing rigid stee conduit is but a fraction of the cost of new work.

There are, of course, many ways to estimate savings For instance, financial set-backs resulting from interrupted service could well exceed the initial cost of safe, dependable rigid steel conduit wiring system.

Then, too, with fire hazards reduced, losses due t

* *From National Tube, America's leading steel pipe manufacturer supplying America's foremost conduit manufacturers*

the greatest single advantage permanent protection against circuit conductors

property damage and production are greatly minimized. In the over-all planning of a wiring system, these costs must be weighed. And, certainly they are. That is why architects and electrical engineers, in their own interests and in the interests of their clients, specify rigid steel conduit as a protective investment.

The adaptability of rigid steel conduit. *"If I had to tear out this system in the next few months . . ."*

The engineer, contractor or architect who guarantees his work experiences this thought every time he designs or installs an electrical system.

It is also one of the reasons why rigid steel conduit has always been a standard of the electrical industry. The quality of this product is time-tested, proven and familiar to everyone who designs and installs electrical distribution systems.

This is primary because circuits can be serviced so easily. A rigid steel conduit permits electrical circuits to be changed and repaired; to grow as the need grows with an absolute minimum of expense.

The removal of defective wires and rewiring with sound ones is merely a matter of pulling out and feeding in. And, the smooth interior or rigid steel conduit makes it even easier to *fish* for wires and cable. *In brief: property does not have to be damaged and there is no time lost in rewiring.*

The ease of installing rigid steel conduit. Rigid steel conduit is easy to install, because it is compatible with all building materials, adaptable to all construction, fits anywhere and expands easily.

Rigid steel conduit is made to A.S.A. Specifications C.80.1 and 2, and is furnished with threaded couplings, elbows and nipples, as well as a full line of standard fittings, outlet boxes and accessories. And, it is available in sizes ½ to 6 inches.

Rigid steel conduit is easy to bend, cut and thread.

It can be installed indoors and outdoors, in dry or wet locations, exposed or concealed, in any hazardous location and under all types of atmospheric conditions.

Rigid steel conduit has great impact resistance; it can be handled roughly in installation and shipment, because it is not easily damaged. Actually, the contractor needs few tools to put in a permanent, safe and economical rigid steel conduit wiring system.

Electricity is a powerful force. And, electrical wiring must be protected to eliminate danger to life and property. For more than half a century, rigid steel conduit has given that protection.

You may obtain additional copies of this report by writing to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.—*America's leading steel pipe manufacturer supplying America's foremost conduit manufacturers.*

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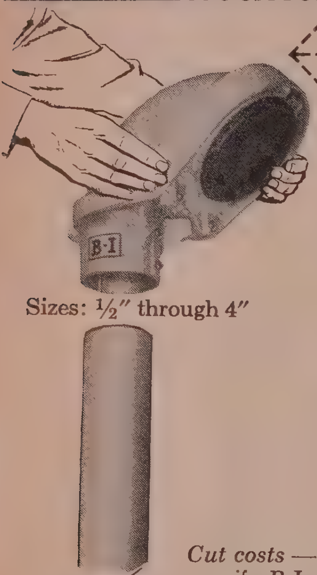

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Blackhawk's exclusive slip-fitter service entrance head has no threads to cut, no extra clamping devices to use. Just slip it over the conduit and tighten two screws. That easy, that fast! Saves contractors $5 to $10 per installation.

Sizes: ½" through 4"

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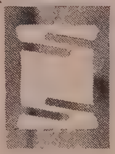

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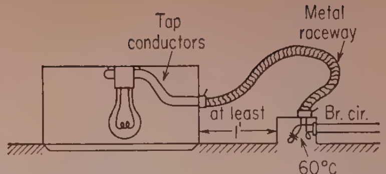

Length of tap conductors 4' to 6'

tap shall extend for at least 4 ft but not more than 6 ft and shall be in a suitable metal raceway."

This rule applies to recessed fixtures having branch circuit terminal connections which operate at temperatures higher than 60C (140F), as covered by Section 410-65 (b). It is significant to note the following advice given by Underwriters' Laboratories concerning their labeled fixtures:

"Recessed fixtures which attain temperatures exceeding 60C (140F) at the point where supply connections are to be made are marked at the point of supply connection to indicate the temperature for which supply conductors are to be suitable. The absence of such marking indicates that 60C (140F) supply conductors are suitable."

If the fixtures in question bear the UL label, the foregoing advice will enable you to distinguish one type from the other by the UL marking. There are several types of recessed fixtures listed by UL where the outlet box is integral with the fixture, and branch circuit conductors, rated at 60C, are brought direct to this outlet box.

Assuming that the fixture in question has terminal connections which operate at temperatures higher than 60C (140F), the illustration shown covers my concept of the rule. The tap conductors from the fixture to the junction box must be not less than 4 ft, and not more than 6 ft in length.—B.A.McD.—6/60/2

NM Cable-Grounding Conductor

Q. *Can a 2-wire non-metallic sheathed cable with a bare ground wire be used to serve a motor operating at 220 volts, single phase?—R.B.*

A. The provisions of Section 210-7 read as follows:

"Where a grounding receptacle is installed as specified in Sections 210-22 (b) and 250-59, to provide grounding facilities required in Section 250-45, the branch circuit or branch circuit raceway shall in-

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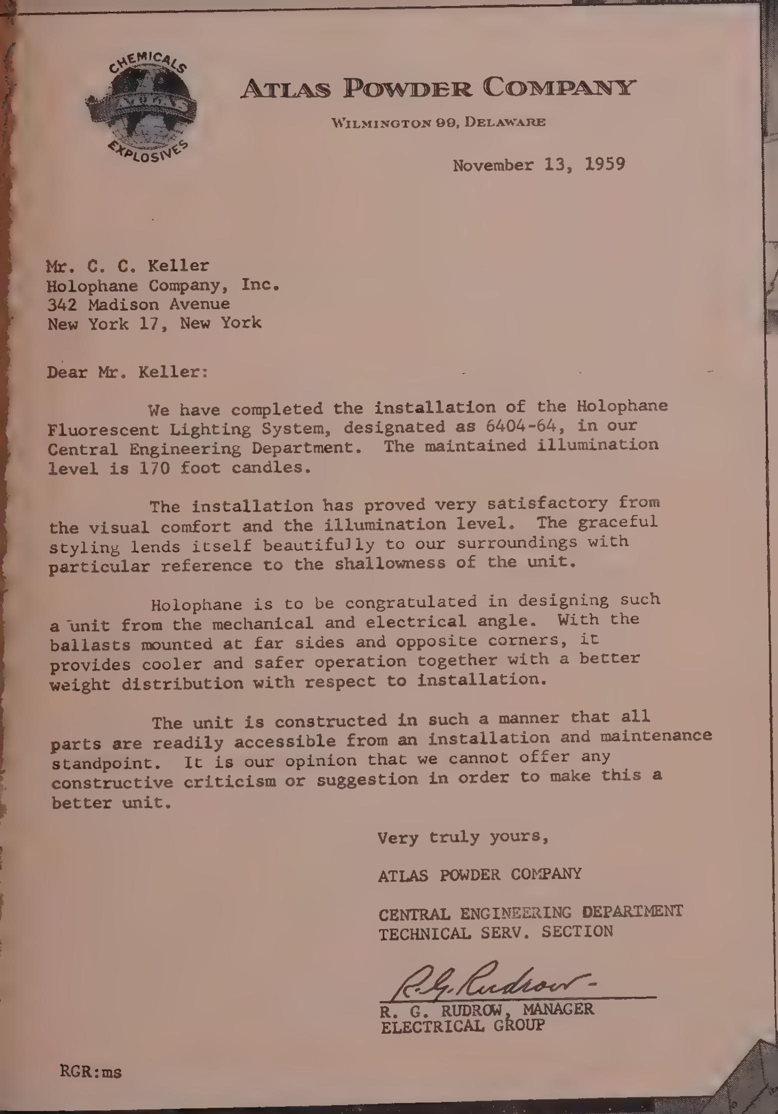

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November 13, 1959

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Holophane Company, Inc.
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CENTRAL ENGINEERING DEPARTMENT
TECHNICAL SERV. SECTION

R. G. Rudrow
R. G. RUDROW, MANAGER
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RGR:ms

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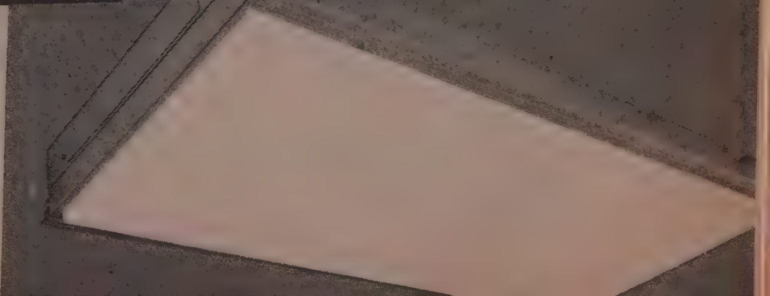


clude or provide a grounding conductor to which the grounding contacts of the grounding receptacle shall be connected."

This rule requires non-metallic sheathed cable, under the conditions covered, to include a grounding conductor integral with the cable.

Section 250-57 recognizes the use of a grounding conductor, integral with non-metallic sheathed cable, for the purpose of grounding fixed equipment. Section 430-145 covers the grounding of motors, and advises, when such grounding is required, it shall be done in the manner specified in Article 250.

In view of the foregoing, it appears evident that a 220-volt, single-phase motor could be served through a non-metallic sheathed cable containing a grounding conductor, provided the grounding conductor is used to ground the frame of the motor.

The principle involved is more clearly covered by a new fine print note under Section 338-3 which reads as follows:

"The above provisions do not intend to deny the use of service entrance cable for interior use when the fully insulated conductors are used for circuit wiring and the uninsulated conductor is used for equipment grounding purposes."

This new fine print note clarifies the status of service entrance cable when serving a 220-volt, single-phase motor where the uninsulated conductor is used for equipment grounding. In the case of non-metallic sheathed cable with a bare grounding conductor, it appears that the code has recognized a similar use for several years.—B.A.McD.—6/60/3

Use of EMT

Q. *Can electrical metallic tubing be used on the outside of buildings where subject to the weather but not subject to severe mechanical damage or injury? Also, can electrical metallic tubing be imbedded in non-cinder concrete above grade level?—B.R.*

A. Yes. Section 348-1 and Section 348-8 of the 1959 National Electrical Code answer both your questions as far as the code itself is concerned, and I quote the above sections:

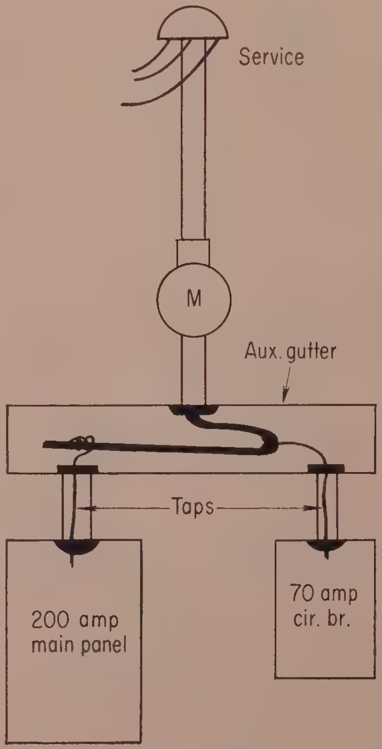
"348-1. Use. Electrical metallic tubing may be used for both exposed and concealed work. Electrical metallic tubing protected from corrosion solely by enamel shall not be used. Electrical metallic tubing shall not be used (1) where during installation or afterwards, it will be subject to severe physical damage; (2) in cinder concrete or fill where subject to permanent moisture unless protected on all sides by a layer of non-cinder concrete at least 2 inches thick or unless the tubing is at least 18 inches under the fill."

"348-8. Couplings and Connectors. Threadless couplings and connectors used with tubing shall be made up tight, and where buried in masonry, concrete, or fill, or where installed in wet places shall be of a type to prevent water from entering the raceway."—R.E.W.—6/60/4

Taps to Main S-E Conductor

Q. *Sketch below shows a service installation consisting of a 200-amp pull-out panel, and a 70-amp circuit breaker for air-conditioning. Since the lugs are not large enough for a direct connection to the main service entrance conductors, does the code permit taps to the main conductors within a wiring trough as shown?—H.G.R.*

A. Section 230-42, Exception No. 2, reads as follows:



"Service Entrance Conductors without Splice.

"Taps to main service conductors are permitted as provided in Section 230-2 Exception No. 3-b or to individual sets of service equipment as provided in Paragraph 230-70(g).

Reference to Section 230-70(g) is the one which applies to the question under discussion. When the service disconnecting means consists of more than one switch or circuit breaker, individual taps may be connected to the main service conductors as shown on your diagram. Insofar as the code is concerned, there appears to be no code violation involved with your proposal. Taps sufficient for the load to be served must be used.—B.A.McD.—6/60/5

Equipment Ground

Q. *Can I, as an inspector, require an equipment ground to be run with the direct burial cable to ground a yard light mounted on a metal pole or standard?—R.B.B.*

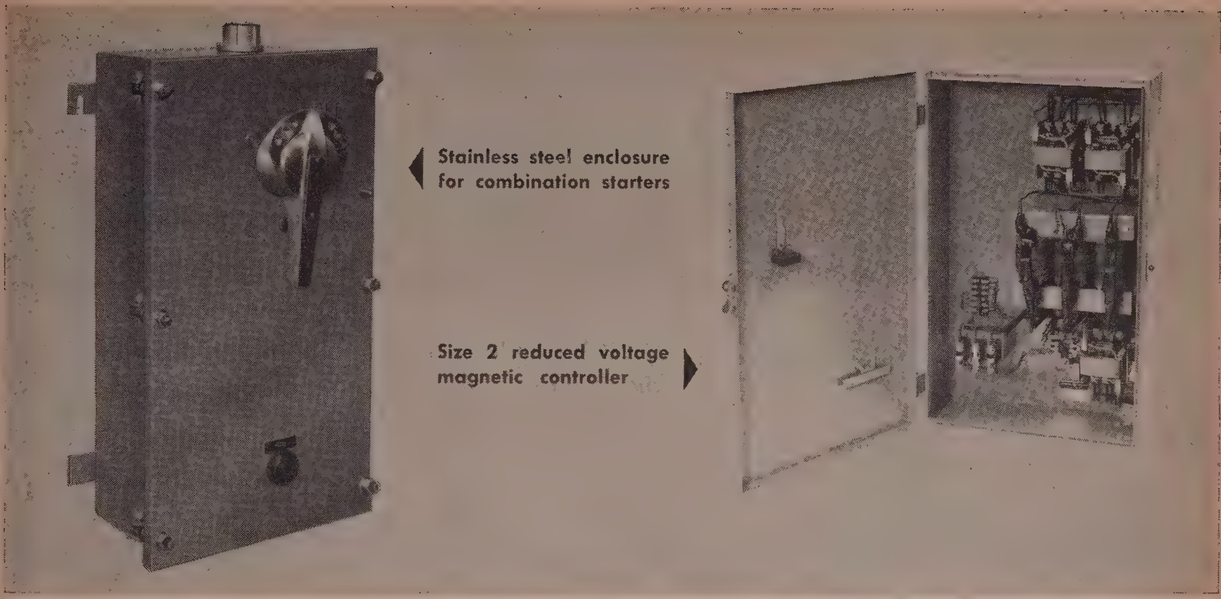
A. Section 250-42 covers the general requirements for grounding such fixed equipment.

In Section 250-57 the requirements for the two general methods for grounding fixed equipment are specified.

The first method covers the use of metallic raceway systems. The second method covers the use of non-metallic raceway systems, i.e., direct burial cable.

When direct burial cable is installed, three methods are shown for grounding. In the first method, the grounding conductor may be part of a cable and may be extended with the circuit conductors in the cable. This grounding conductor in the cable may be uninsulated, i.e., bare. However, if it is provided with insulation or if it is only covered, this individual insulation or covering shall be finished to show a green color.

The second method provides for the installation of a separate grounding conductor. In general, the intent is that this separate grounding conductor should be considered as part of the other circuit conductors and thus shall be extended with them. It is presumed that it may be uninsulated or that it may have insulation or only a covering. Where it is uninsulated, its installation would, in my opinion, be covered also by the require-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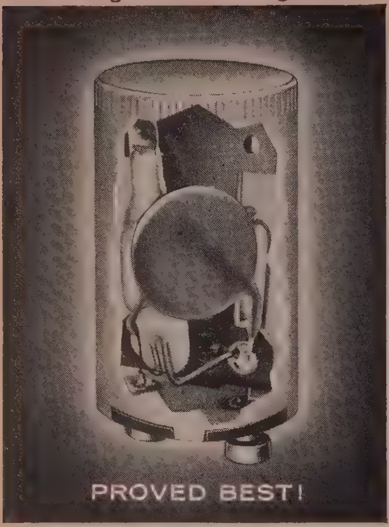

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ments of Exceptions No. 1 and No. 2 of Section 230-30. There is no direct reference to require the bare grounding conductor to be: 1) of copper, and 2) installed in duct or conduit; but it certainly would seem that the principle of installation would be the same for both cases.

The third method permits any other types of installation if the local code authority grants special permission for such an installation. This would permit the inspector, for example, to allow the equipment grounding conductor to be run separate and possibly in another trenchway system from that of the circuit conductors if he had some definite reason for doing so. It should be noted, however, that this requires the special permission of the inspector, so that I would say that the inspector may at all times require the equipment grounding conductor to be extended with the other circuit conductors as outlined in the first two methods above.—B.Z.S.—6/60/6

Foreign Systems in Substation Enclosures

Q. *Is it permissible for the vacuum breaker and vent piping of underground fueling storage tank to be installed within the fenced enclosure of a 13,000-volt substation? The only apparently applicable section I can find in the National Electrical Code is paragraph 450-47 which prohibits the installation of pipe or duct foreign to a transformer vault. The cross reference in paragraph 701-31 appears applicable only to transformer vaults, not fenced enclosed substations.—D.J.N.*

A. The provisions of Article 710 apply in general to all circuits and equipment operated at more than 600 volts. Section 710-11 of this Article reads in part as follows:

"Outdoor installations shall be accessible to qualified persons only. Installations are considered to be accessible to qualified persons only where enclosed as provided in Section 710-31 or when isolated by elevation, etc."

Section 710-31 reads in part as follows:

"Electrical installations in a vault, room, closet or in an area surrounded by a wall, screen or fence, access to which is controlled by lock and key or other approved means, are considered to be accessible to qualified persons only. The type of enclosure used in a given case shall be designed and constructed according to the nature and degree of the hazard(s) associated with the installation."

It is quite evident, in view of the foregoing, that Section 710-31 is concerned with outdoor installations similar to the one described in your question. As a result, any system or equipment foreign to the electrical system should not be installed within the fenced enclosure. The vacuum breaker and vent piping may require maintenance, and the mechanic assigned to such work ordinarily would not be considered as qualified, and could not enter the enclosure. Tank vents may become plugged and should be inspected frequently. The situation is similar to that which concerns transformer vaults as covered by Section 450-47.

Another factor to be considered concerns the nature of the combustible liquid stored. Vents are provided to prevent the build-up of pressure within the tank. When an underground tank is being filled, considerable vapors are driven from the vents and may accumulate within the substation area, and they may be ignited by an electrical arc. Such a combination of hazards should not be permitted, and it appears that Article 501 covering hazardous locations could enter the picture. A 13,000-volt substation represents an investment which should not be exposed to the hazards incident to flammable gases or vapors.—B.A.McD.—6/60/7

Exit Lights

Q. *Where does the National Electrical Code specify size, wattage and location of exit lights or lights for an outside stairway or fire escape?—B.R.*

A. Your question is one that is not answered in the National Electrical Code. The National Electrical Code is National Fire Protection Association publication No. 70 as well as National Board of Fire Underwriters publication No. 70. In Article 700 of the National Electrical Code the wiring for emergency systems is covered with reference to another National Fire Protection Association publication, No. 101, Building Exits Code. You will find the information requested in the Building Exits Code. —R.E.W.—6/60/8

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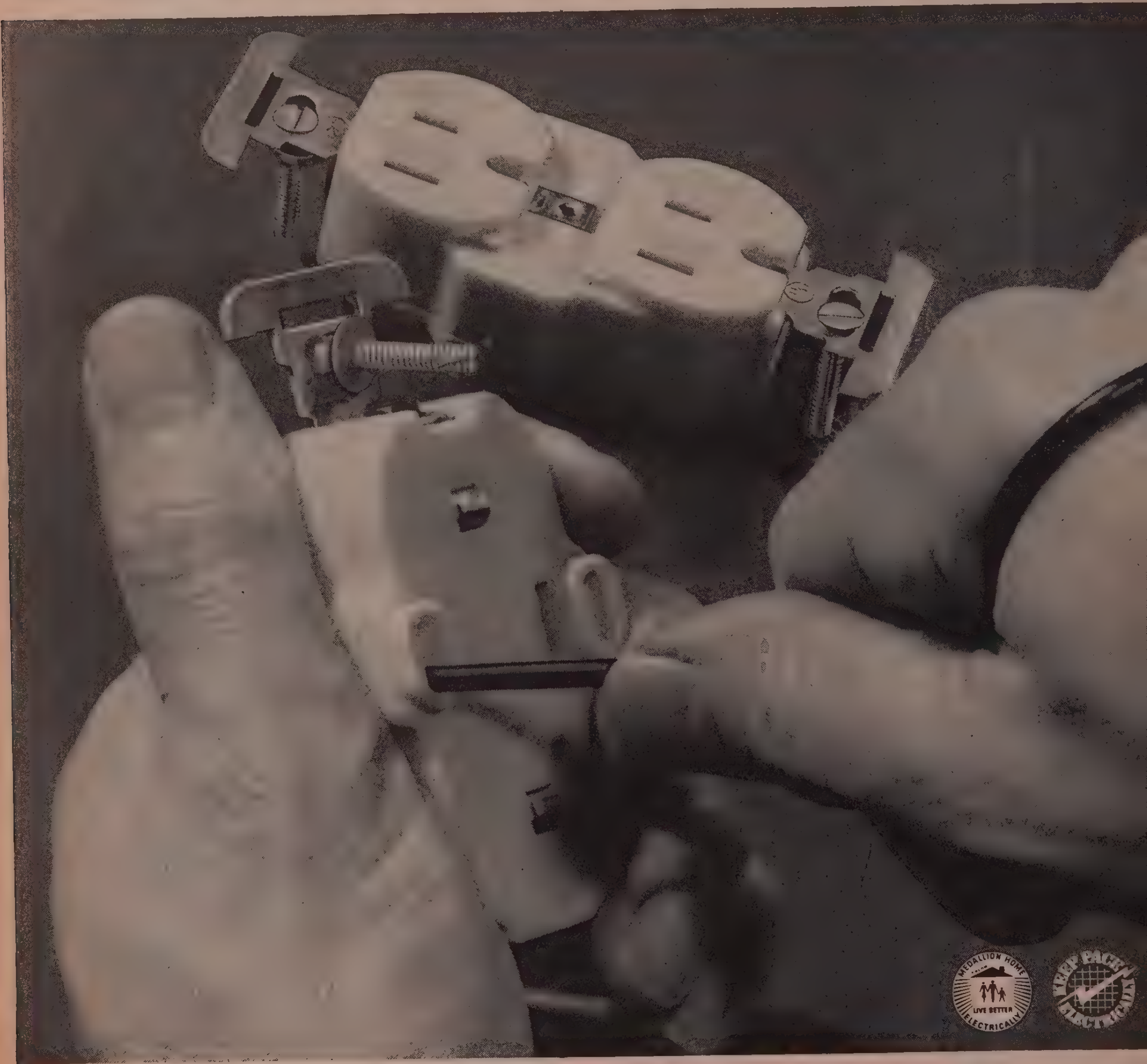

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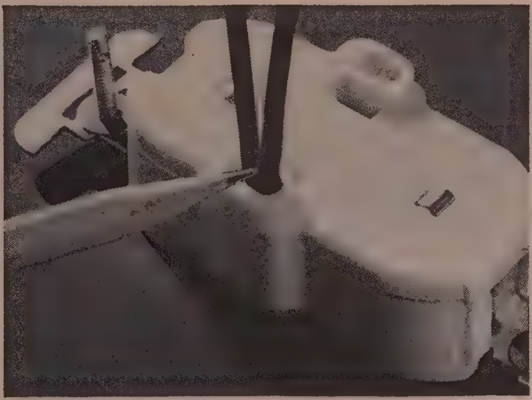
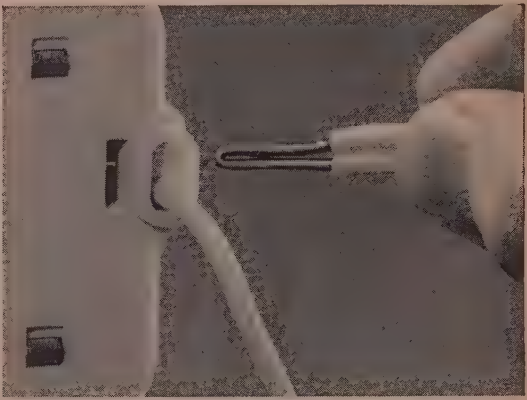


2. **Notice the safety feature** of totally-enclosed connections. They protect against grounds and shorts; there are no exposed current-carrying parts. And these back-wired terminals won't bend or loosen when you push the outlet into the box. Pressure on the wires just tends to seat them deeper.



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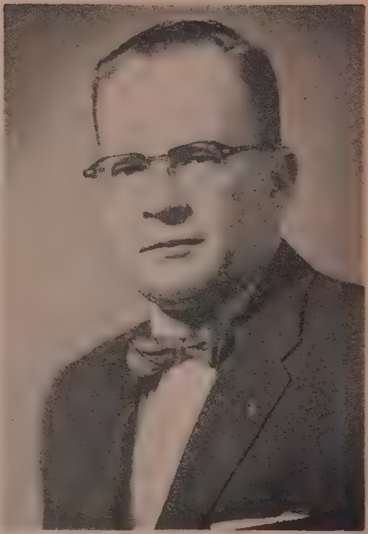


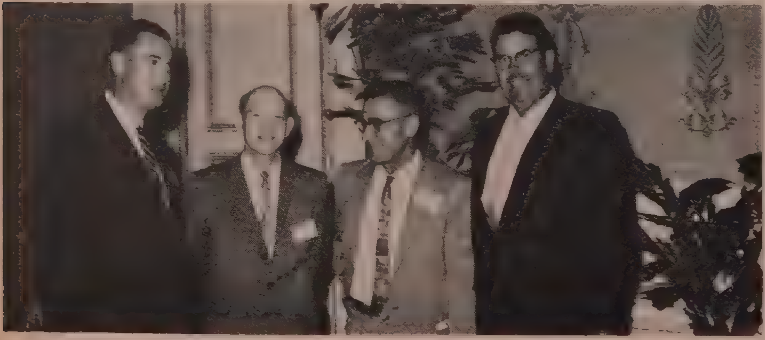
NEW NISA PRESIDENT, J. Arthur Turner, Jr., executive vice president, Tampa Armature Works, Tampa, Fla., is following in the footsteps of his father who was association president in 1944-45.

MORE than 1,000 electric motor repair shop operators and their guests met at Miami Beach's Hotel Fontainebleau May 8-11 for the 27th Annual Convention of the National Industrial Service Association. Following the general theme of "Management in the 60's," conference sessions explored various managerial techniques that lead to an efficient, profitable service shop operation in the face of rising costs and increased competition. Between sessions, delegates had an opportunity to view exhibits of more than 50 equipment manufacturers and suppliers.

Convention keynoter Edward S. Helm, president, Reliance Electric & Engineering Co., Cleveland, Ohio, predicted a decade of increasing market potential for electrical service sales. By 1965 service shops should be getting twice the amount of work available in 1960; by 1970, this should be three times the present volume. Contributing to this anticipated market is the growing trend of industrials to de-emphasize or discontinue the so-called "captive shop" repair operations. New plants are being built without electrical service shops of their own. Other plants are following this pattern. But, it is going to take aggressive selling by motor service shops to accelerate this trend, he warned.

Mr. Helm also predicted that more new equipment will be installed in the next ten years than is presently operating today, including all types of motors and sophisticated electronic controls and devices for automation. This means more maintenance to reduce costly down-time on production lines. Service shops can and should take advantage of a growing interest of industrials in contract maintenance to: 1) cover an entire plant; 2) supplement plant crews; or 3) take care of special or peak load type maintenance.

Shops must think now of preparing their organizations to handle this anticipated increase in work load. Helm believes many of the problems that will arise can be solved by application of improved professional management techniques to the individual shop operations. This means a planned approach to: recruitment of skilled workmen and technical personnel; personnel training; sales growth; product and service improvement; cost and inventory controls; shop organization; customer and community relations; credit, capital and profit improvement. One way to achieve these goals is for each shop owner or manager to draw up with his own people a suitable set of business objectives to guide the shop's future growth, Helm concluded.

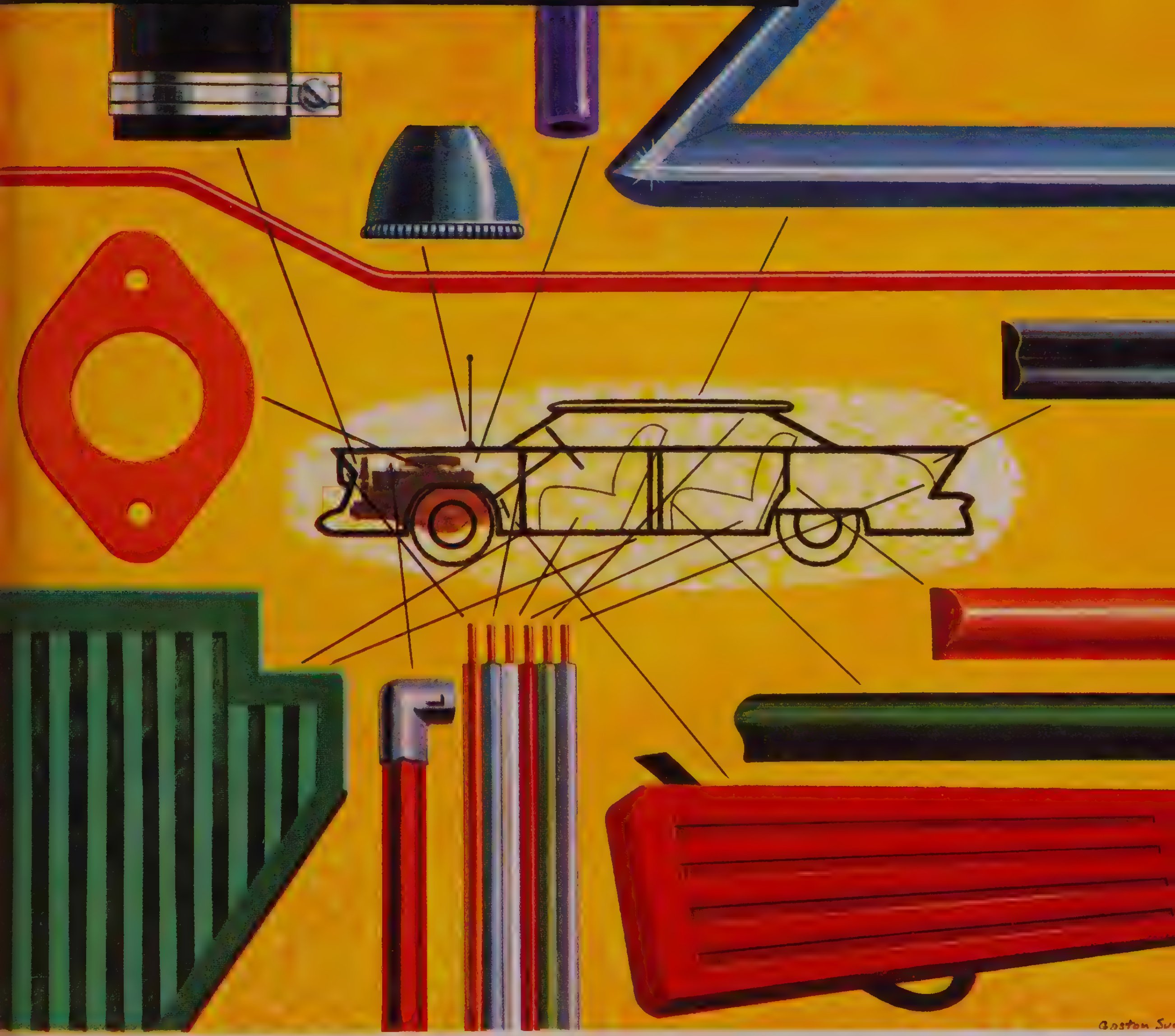


CALIFORNIA CONTINGENT at NISA Miami Beach convention included: (L to R) W. T. Martin, Electrical Specialty Co., San Francisco; Clare Marsh, Roy M. Butcher Electric Co., San Jose; Frank Silveria, Frank Silveria Motor Shop, Los Banos; and Jack Van Alstyne, Van Alstyne & Son Electric, Sacramento.

Management ABC's

Service shop business assets, employee benefits, and customer credit were among the management subject categories discussed at the conference. One of the prime assets of successful business is the ability of management to know its business strengths and exploit them and to recognize its weaknesses and protect against them, stated Norman D. Johnson, vice-president A-C Credit Corp., Allis-Chalmers Mfg. Co., Milwaukee, Wis. While the next decade is expected to present an excellent and challenging economic climate for the motor service shop, survival under keenly competitive conditions may well hinge on individual management skills. Dun &

THE OIL-RESISTANT, OZONE-RESISTANT NITRILE RUBBER



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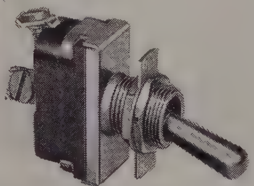

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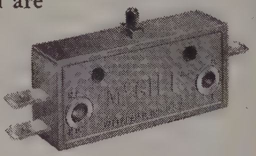
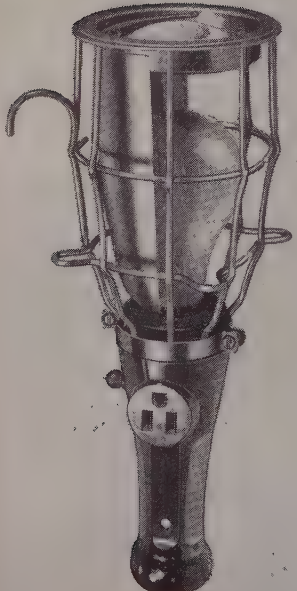


McGILL PORTABLE LAMP GUARDS



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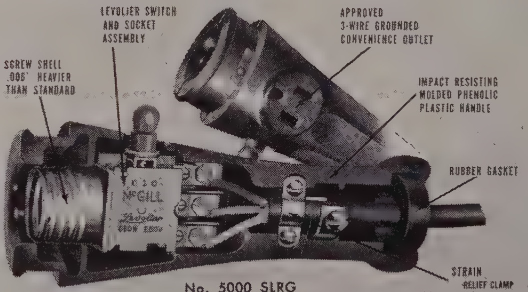
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precision needle roller bearings

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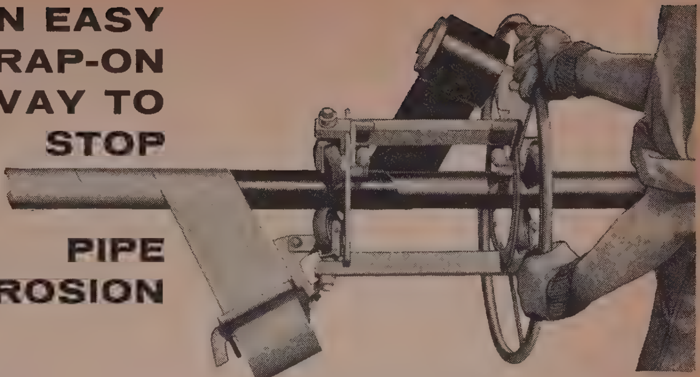
KEYNOTE SPEAKER at NISA's Miami Beach convention, Edward S. Helm, president, Reliance Electric and Engineering Co., Cleveland, tells shop men to look for and be prepared for a doubling or tripling of the electrical apparatus service market in the next ten years.

Bradstreet, Johnson noted, attribute 90% of business failures to lack of balance in skills and experience, managerial incompetence, inadequate original capital. Small business typically tries to stretch limited capital too far, over-extends credit to get customers, is top-heavy with slow-moving inventory, has limited knowledge of the market and less of knowledge of competitors, is naive in attempts to raise badly needed money, he added. To avoid these pitfalls, Johnson suggested establishment of a sound credit policy, maintenance of adequate financial and cost records, counsel with qualified business specialists (bankers, etc.), development of a clear concept of your own business operation, and application of good management methods. Remember, you must outmanage your competitor, and a thin profit margin leaves no cushion for managerial mistakes, he concluded.

Employee benefits play an important role in today's compensation pattern. In fact, they account for a startling 15% to 25% of payroll, according to Paul L. Miller, Miller & Horovitz Associates, Jacksonville, Fla. Shop men heard Mr. Miller suggest and explain the self-administered, tax-exempt business trust as a possible employee benefit, personal estate builder, or a means of building up a capital expenditures fund. Each deposit in the trust is deductible from profits for tax purposes, and earnings are tax-exempt with only long-term capital gains to pay when you take the cash, he advised. Shop owners should consider having a competent firm analyze their operations to see whether such a trust will help achieve their business goals, he concluded.

On the subject of tax deductions,

AN EASY
WRAP-ON
WAY TO
STOP
PIPE
CORROSION



CHASEKOTE* Pressure-Sensitive Polyethylene Tape has an extra-heavy adhesive mass that clings to clean pipe on contact . . . makes a perfect, permanent bond that rustproofs, waterproofs and insulates pipe against all types of corrosion.

CHASEWRAP* Protective Overwrap is a tough, wrinkle-free outerwrap that shields against abrasion, wear, and physical damage to the tape. Wraps simultaneously with the tape. Superior to rag and felt wraps, yet far lower in cost.

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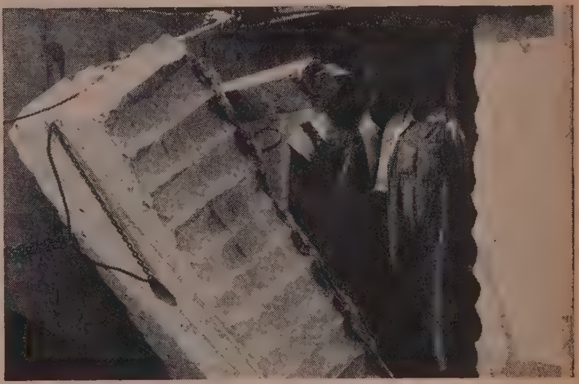
The new CORR-PREV Pipe Coating Team comes in easy to handle tape form. It goes on pipe faster and lasts longer than corrosion-proof paints. It's cleaner and simpler to apply, too, than hot tar coats. And most important, this new CORR-PREV Team offers all the cost-cutting, pipe-saving advantages of polyethylene tape.

With CHASEWRAP Abrasion-Resistant Overwrap and Chasekote polyethylene tape, you get the easiest and best pipe protection at lowest applied cost! There's no heating, drying, clean-up or shut-down time. Each roll is factory-uniform in thickness and quality. And all coating materials — including rental of high-speed applicators — are available from one reliable source. Want samples? Specs? Prices? Write **CHASE & SONS, INC., 26 Spruce Street, North Quincy, Massachusetts.**

FOR YOUR ELECTRICAL INSULATION PROBLEMS SPECIFY CHASE FRICTION, PLASTIC, RUBBER, NEOPRENE & BUTYL TAPES

CUTTING POWER!

Doors Through 18-inch Walls



How do you cut doors and windows through *18-inch reinforced concrete walls* without ruinous delays? A general contractor got the job done and out of the way with Longyear diamond drilling equipment. *Workmen cut around the openings with 6-inch diamond bits*, and carefully lifted out the giant slabs of concrete. The whole job was done in a few days at low cost and the entire project was kept on schedule. Your Longyear dealer can show you *other* diamond drilling applications that are cutting construction costs, and tell you about the new industrial diamond drills.

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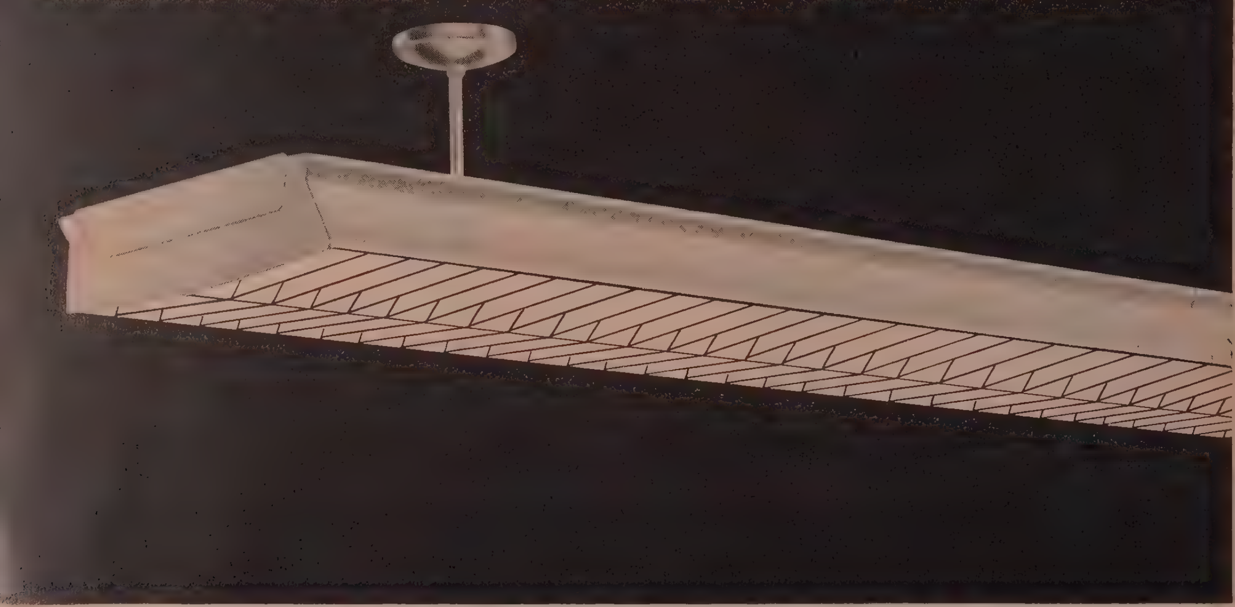
WORLD'S FIRST 12-FOOT FIXTURE...



Here's proof of installation savings.......

GUARANTEE

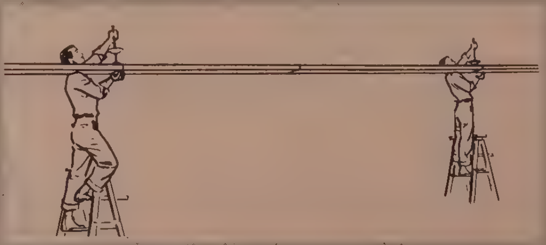
Others talk about installation savings. Garcy guarantees them!

Our new 12-ft. fixture makes it possible. On 9 out of 10 sizable jobs we can actually offer a signed guarantee that, from the time ceiling hickeys are in place, total assembly and hanging time will not exceed 1½ man-hours per 24 ft. of fixture. If this time is exceeded on a job covered by our signed guarantee, excess time may be billed to us.

The guarantee figure is less than half of ordinary labor estimates for fixture installation. Even at that the chances are it will be halved again on the actual job.

And this is top quality lighting. Efficient, well-shielded, low-brightness lighting that meets today's higher lighting standards for schools and offices.

Runs of any length joined and wired at work level.



Runs of any length raised to the ceiling as a single unit.

GARCY SUPER SPEED-LINE

- 45°x45° SHIELDING
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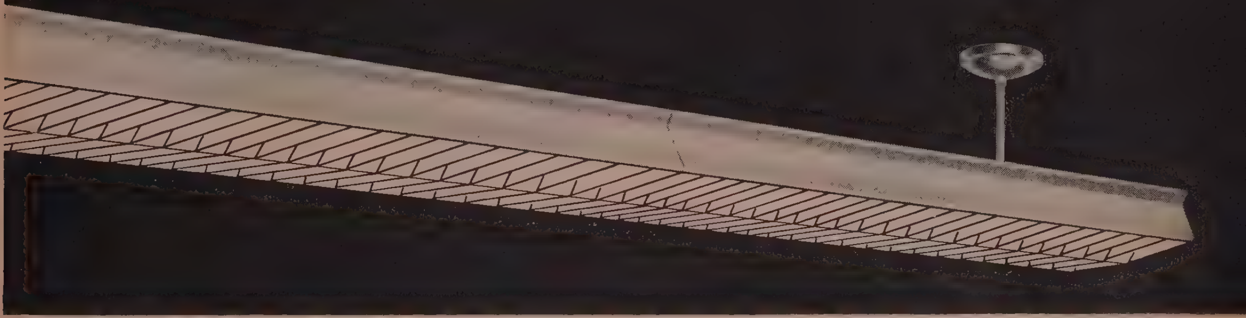
- FEWER HANGERS NEEDED
  (ONLY 3 PER 24 FT. ROW)



...a new and unique man-hour guarantee

GUARANTEE

Here's why Super Speed-Line savings can be guaranteed.

1. 12-foot fixtures mean less handling, fewer couplings, fewer splices. Only two fixtures per row in a typical classroom.
2. Stem spacing up to 12-ft. O.C. means fewer hangers, fewer supports. Only three stems for runs to 28 feet.
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4. Unit-hanging means complete runs are raised to the ceiling as a single unit. There's an absolute minimum of ladder time.

HOW TO GET A SUPER SPEED-LINE GUARANTEE

This advertisement is an offer to furnish a guarantee of labor time on jobs meeting certain reasonable conditions; it is not a guarantee in itself. The actual guarantee is a document rendered on an individual job basis, signed by an officer of Garcy Lighting and countersigned by the electrical contractor.

Send today for a facsimile copy of the guarantee and complete details on the Super Speed-Line system. Use the coupon for a prompt reply.

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Division of Garden City Plating & Mfg. Co.
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- 14 gauge galvanized steel.

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NORTH CENTRAL shop men enjoying coffee and juice break at NISA Miami Beach convention included: (L to R) A. R. Adams, Powerite Electric Motor Co., Austin, Minn.; R. H. Root, Electric Motor Supply Co., Minneapolis, Minn.; A. J. Kuzniewski, Quality Electric Service, Milwaukee, Wis.; J. P. Miller, Electric Motors Unlimited, Madison, Wis.; and Oliver Klemp, Electric Motor Service, West Bend, Wis.

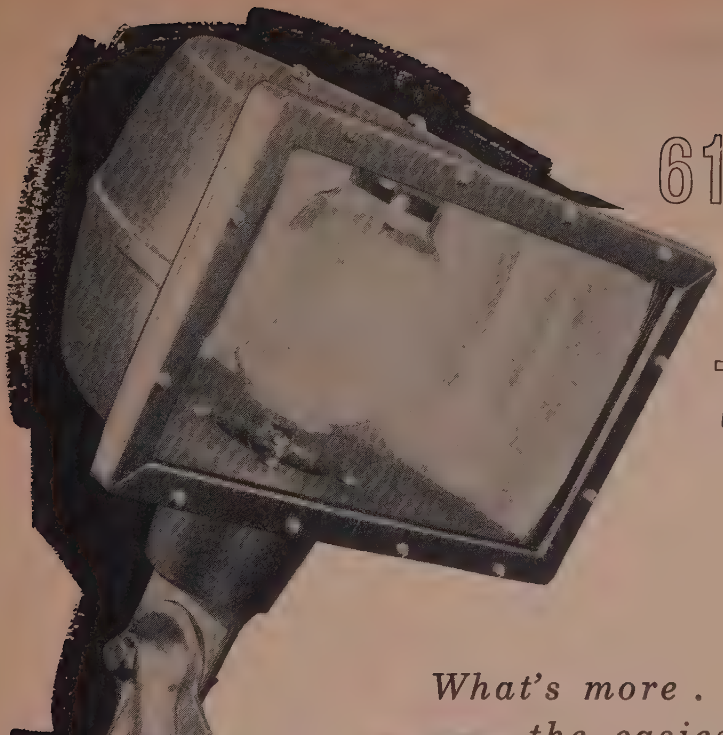
James Miller, tax attorney, Jacksonville, Fla., reviewed Internal Revenue Service's latest slant on entertainment and depreciation expenses. He advised shop owners and their key employees to keep more accurate records of expenses to substantiate deductions, noting that the additional paper work will save money and grief in the long run.

A sound credit policy is a vital factor in a business operation and the way it is handled has a definite effect on customer relations, noted Roy A. Bliss, Dow Corning Corp., Midland, Mich. Customer credit should be based on his integrity, his ability to operate a profitable business and his financial soundness. If he should request extension of additional credit on a temporary basis, visit his place of business for your own appraisal. Such a clearly defined extension may help him over a hurdle and make a loyal customer. A prudent, but flexible credit policy administered in a courteous and friendly manner can lead to constant improvement of customer relations, Bliss concluded. But, avoid being an "easy mark." This frequently leads to credit abuses, he warned.

The customer who buys your service is the VIP of your business and everyone in your organization should realize this, stated Col. M. M. Frost, vice president, Eastern Airlines, New York. He deserves your consideration, courtesy and the finest service you can give him. For, in the long run, he pays your bills, your staff salaries, your overhead, and makes possible your profits. Through him confidence in, and the reputation of, your firm is established. Col. Frost was emphatic in pointing up the role of courtesy in customer relations. A satisfied customer is more than a salesman—he is your employer. Treat him indifferently or discourteously and he will fire you from his payroll. Show him consideration and he is yours forever, Frost concluded.

A well-conducted employment interview is still the most practical and valuable way to "size-up" an applicant, according to Byron B. Harless, Byron B. Harless & Associates, Tampa, Fla. A quick, slipshod session by an unprepared, untrained interviewer cannot produce an accurate appraisal of the applicant, he warned. The interviewer should work with a well-defined job description and a list of pertinent questions that will probe the applicant's education and training, work habits, behavior pattern, loyalty, job stability and progress, perseverance, and ability to get along with others. Take at least 30 to 60 minutes for the interview and control your own bias to maintain an "objective" level, he cautioned. Remember, a key to what the applicant will do for you is what he has done in the past, Harless concluded.

What does a motor manufacturer expect from a repair shop as a motor distributor? One answer came from A. Callaway Allen, sales manager, Wagner Electric Corp., St. Louis, Mo. In his estimation, a repair shop should: serve as a sales organization, training salesmen and adopting the tools of good sales management; give sufficient coverage of potential customers; follow through after a sale and handle complaints and make adjustments; call on manufacturer for technical assistance where required; limit, or forego competing lines of motors; maintain an adequate stock of motors. Allen believes compensation to a motor distributor should be in direct proportion to the service he performs. As to the expanding economy of the decade ahead, Allen feels that the motor repair shop



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700% LONGER LAMP LIFE!

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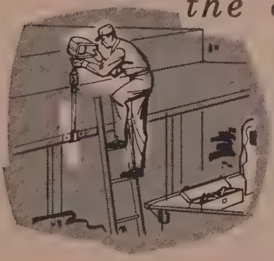

Just slip Wide-Lite Junior's combination ballast box and mounting bracket over any 1¼″ pipe mast, and you're all set for the finest floodlighting possible. There's no additional electrical work which remote ballast locations require. Now it's easy to convert older floodlight installations into efficient Wide-Lites with color-corrected mercury vapor lamps!

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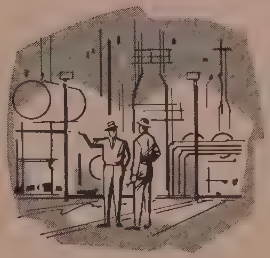

At 250 watts, Wide-Lite Juniors with mercury vapor lamps have 10,500 lumen output as compared with 3,750 for incandescent lights . . . at 100 watts, 3,300 lumen output as compared with 1,630 for incandescent lighting. And Wide-Lite's exclusive segmented rectangular reflector gives a broad light pattern without "hot spots" or shadows.

Wide-Lite Juniors are ideal for lighting service entrances . . . loading docks . . . gardens . . . highway signs . . . and for use as night lights and local lighting in industrial plants.

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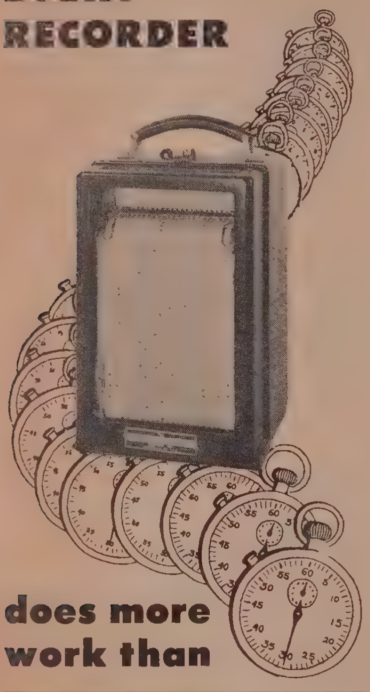

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- Productive and idle time.
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- Sequence of switching as in
  - —appliance control testing,
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You save time and costs with these versatile recorders which "picture" both sequence and duration of events—in production and processing . . . in research . . . in plant safety.

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NISA AWARD WINNERS get checks at NISA Miami Beach convention from contest committee chairman Alex Shovan (right). They are: (L to R) R. H. Farrar (for F. A. Robinson), Frederick A. Farrar, Inc., Keene, N. H.; John Steffner (for W. C. Bedoit), Chattanooga Armature Works, Chattanooga, Tenn.; Price Waddell, Decatur Electric Service Co., Decatur, Ala.; and George K. McKeowan (for R. F. Janos), MQN Electric Motor Service, Mentor, Ohio.

with "equal technical and management know-how" is the class of distributor best suited to do a job for the motor manufacturers.

Business pressures can make a man forget about himself. Dr. Edward R. Annis, Miami physician and surgeon, admonished convention delegates to give a little time and thought to their own health. Consider your body a machine, like a car or the equipment you repair, and give it the same regular checkup and maintenance you recommend to your customers. Make a habit of getting a good physical examination annually and keep mind and body reasonably active after retirement, he advised.

Technical Talks

A new "strip winding" technique for coils with aluminum strip and foil was described by R. R. Cope, manager electric winding sales, Aluminum Company of America, Pittsburgh, Pa. With the strip method, turns and layers are electrically synonymous and insulation need only be provided for turn-to-turn voltage in contrast to the possibly higher layer-to-layer voltage in conventional coils. Because thinner insulation can be used with strip conductors, space factors in the range of 70% to 95% are possible, he noted. Cooler running temperatures are another advantage of strip-wound coils. Lead-wire connections are made to the strip with either ultrasonic or cold welding at room temperatures without the need for flux or solder. Since precoating the aluminum strip with insulation would provide a greater margin of safety, ALCOA is now experimenting with various types of insulating coatings, he revealed.

The problem of shop selection and inventory of insulating materials has become increasingly complex as a somewhat bewildering maze of new items come on the market. To resolve this, Dr. Jack Turner Wilson, chief physicist, The Louis Allis Co., Milwaukee, Wis., suggested that shop management perfect an insulation-standardization plan. Knowing the performance characteristics and application range of insulations most adaptable to the types of work done, selecting those used most, and developing efficient application techniques will simplify insulation inventory control and cost and increase shop efficiency, he added. In fact, Turner suggested that NISA form a committee on insulation standardization to recommend basic types of insulation systems to its members.

In line with simplification, he noted that the use of thixotropic or quick jelling epoxy compounds, which can be applied by dipping, eliminates the molding operations needed for monolithic casting of epoxy or polyester resins used in the encapsulated insulation system for both form-wound and mush-wound equipment. Another category of operation will be added when demand appears for silicone elastomer encapsulation for the repair of form-wound rotating machines, he revealed.

The air conditioning industry has reached the point where it needs motor repair shops who will set up separate, specially designed and equipped facilities to rewind hermetic motors. That is the view of Thomas A. Lutz, supervisor, engineering laboratory, Airtemp Div., Chrysler Corp., Dayton, Ohio. Compressor failure analysis during the past few years show 70% of failures due to motor burnouts. Experienced shortcomings of the re-

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"rifle bore test"

See *why* wires fish easier through super smooth Clayton Mark "ELECTRICTUBE"

• **SUPERIOR ENAMEL** • **SMOOTHER I.D.** • **EXCLUSIVE D.C. WELD**

Like the sleek, smooth barrel of an army rifle on inspection — Clayton Mark thinwall electrical conduit meets all tests to stand above competition. Manufactured from superior quality steel, "Electrictube" withstands the abuse of construction yet bends and cuts easily. The interior surface is coated with a specially prepared enamel that won't soften, gall, flake or chip. Continuous D.C. Weld is an exclusive feature. Conclusive tests have proven that wires pull through Clayton Mark conduit with the least pressure under a variety of temperatures and conditions. Yes, take another look . . . and order Clayton Mark conduit — the "Contractor's Favorite" for more than a half of a century!

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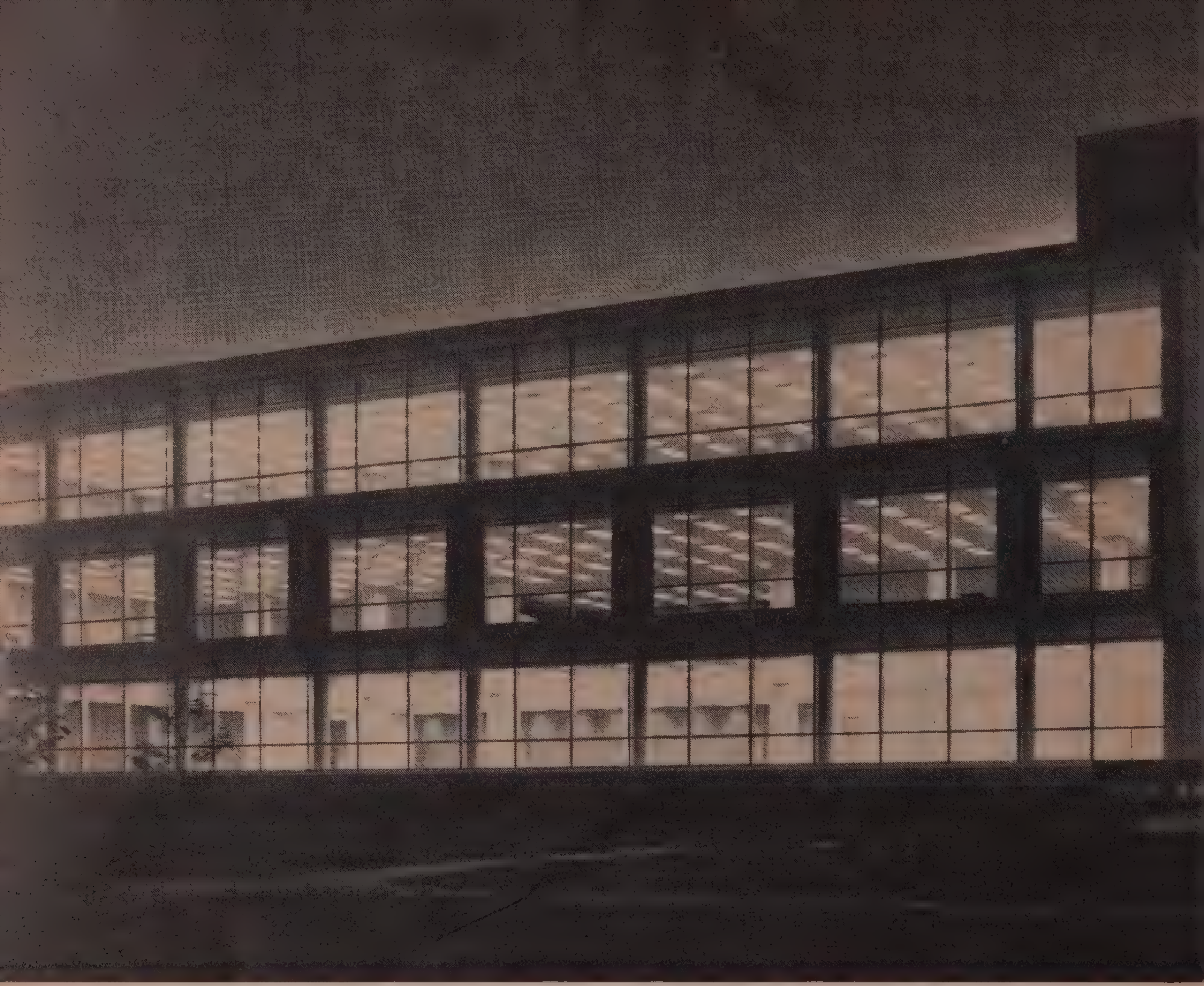
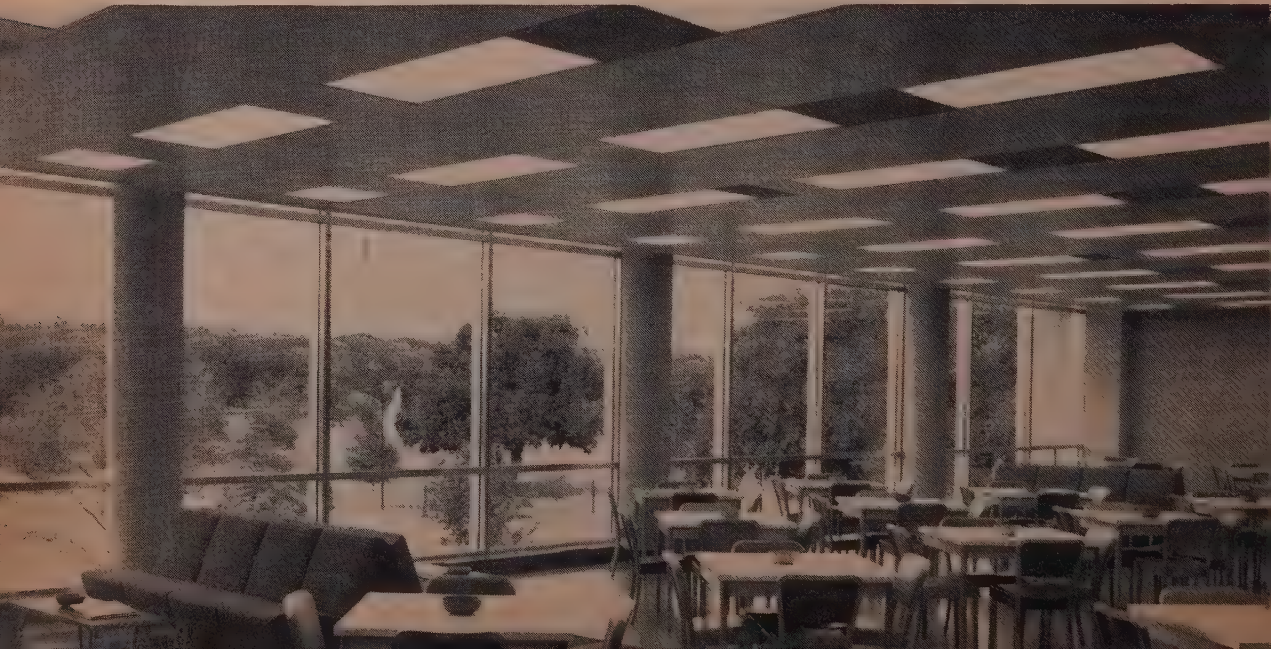
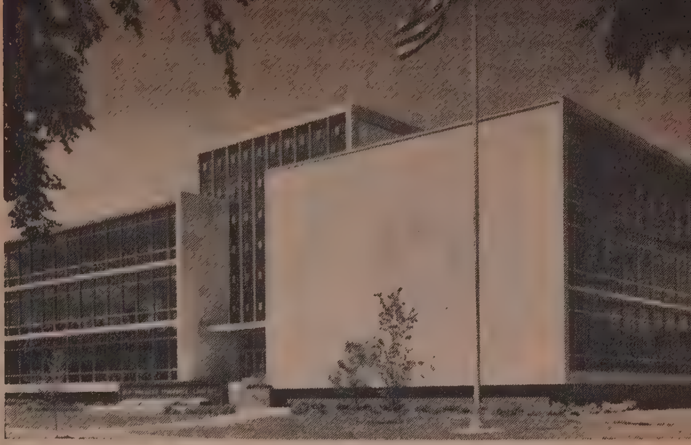


More than 1800 fluorescent fixtures in Old American's new building help create this striking nighttime impression.

110 footcandles of glare-free illumination are maintained throughout, including this attractive lounge for employes.





How Old American Insurance C ended the great lighting search with Day-Brite

True to Missouri tradition, Old American Insurance C adopted a "Show Me" attitude when considering lightir for their new Kansas City headquarters.

They contacted their local power and light compar engineers. Consulted the experts at General Electric's fame Nela Park. Even made their Addressograph Department "lighting laboratory" and installed competitive fixtur side-by-side.

Result? For lighting effectiveness with high visual comfor over-all economy with trouble-free maintenance, and pleasir appearance, Day-Brite lighting was the clear-cut choice.

May we show *you*? Call your Day-Brite representative, liste in the Yellow Pages, for the FACTS and FIXTURES! *Day-Bri Lighting, Inc., St. Louis, Mo. and Santa Clara, Calif. Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Or*

Modular design, incorporating Day-Brite Mobilex® with Cleartex® enclosures, permits complete flexibility in arranging offices and work areas.

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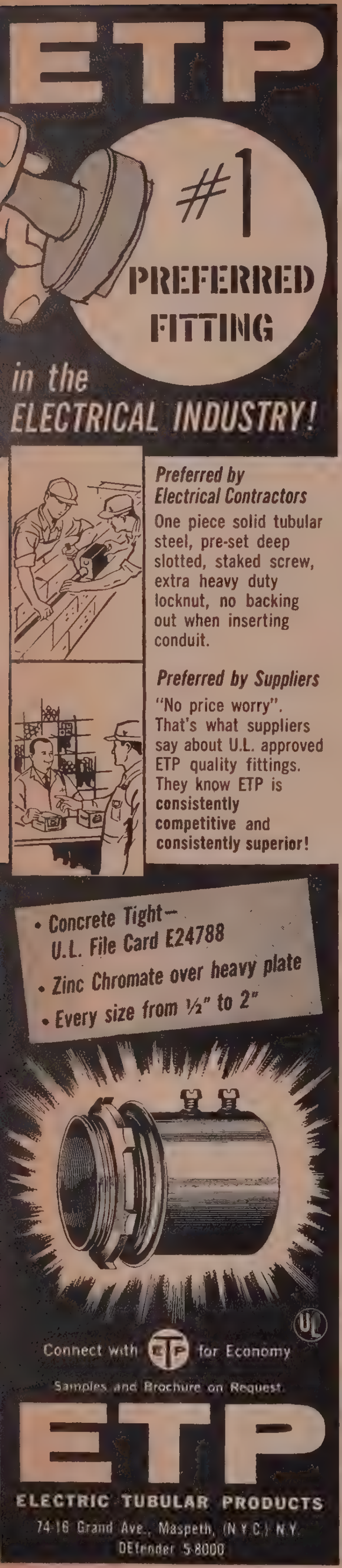
NATION'S LARGEST MANUFACTURER OF
COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



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#1 PREFERRED FITTING in the ELECTRICAL INDUSTRY!

Preferred by Electrical Contractors
One piece solid tubular steel, pre-set deep slotted, staked screw, extra heavy duty locknut, no backing out when inserting conduit.

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J. H. PARRISH, Parrish-Johnson Electric Co., Inc., Danville, Va.; Bill Nelson, Nelson Electric Co., Richmond, Va.; W. F. Weirich, Lenni Products, Inc., Lenni Mills, Pa.

wind motor lie mainly with the use of insulating materials which are incompatible with refrigerant and oil and failure of repair shops to maintain the same rigid material and quality controls and dirt-free facilities that motor manufacturers provide, he explained.

Motor manufacturers have developed three basic new insulation systems for hermetics. These are: 1) all acrylic; 2) all polyester; and 3) a combination of acrylic and polyester. While the latter is the best over-all system at present, the all polyester method may prove equally as good or better after further testing, he noted.

Encouraging shops to establish hermetic rewind service is difficult, since it means an investment of $10,000 to $15,000 in additional plant (air conditioned) and equipment. To make this pay off, a shop would have to do about $30,000 to $40,000 annually in hermetic rewinds. Such shops would have to be in key metropolitan centers, he admitted. Delegates were given a precise picture of the plant, equipment and repair techniques needed for this type of service. Once a shop decides to get into this field, it is imperative that compressor manufacturers' recommendations as to materials and processing of hermetic motors be closely followed, Lutz concluded.

Business Session

J. Arthur Turner, Jr., executive vice president, Tampa Armature Works, Tampa, Fla., is the new international president of the National Industrial Service Association, Inc., an organization of 1,600 electrical apparatus service companies in North America. Other NISA officers for the 1960-61 term are: vice president—George Larsen, partner, Larsen-Hogue Electric Co., Los Angeles, Calif.; secretary—B. J. Horton, general manager, The Atkinson Armature Works, Pittsburgh, Kansas; treasurer—Alex A. Shovan, owner, Industrial Electric Service Co., Hawthorne, New Jersey.

Summary reports of association activities revealed the following:

The formerly independent Small Business Protective Committee is now part of the association and will be known as the SBPC of NISA. The committee had and will continue to investigate the impact of motor manufacturers' repair shop expansion programs on the business of the small independent shops. This is particularly significant in areas where adequate repair shop facilities already exist.

NISA gained 86 new shop members last year; has 40 chapters, an expanding Canadian membership, and hopes for a chapter in Mexico City.

Practical Technical Seminars to update members in new materials and new insulation systems have been and will be held in several cities. NISA is considering the possibility of having a testing laboratory analyze new materials as they come on the market as an additional member and customer service.

Starting in September, NISA will conduct 6 or 7 Management Seminars throughout the country.

About 9% of NISA shops polled are interested in rewind and repair of hermetic motors. The NISA Rebuilding Standards Committee will be asked to establish standards for this type of motor.

Because of apparent lack of interest on the part of members, the NISA Awards Contest for shop ideas will be discontinued until further notice.

BERT HANNEWALD and Al Whisenand, Scherer Electric Co., Indianapolis, Ind.; W. H. J. Kayser, Wayne Electric Co., Ft. Wayne, Ind.

how good should power cable be

...*for long term stability?*

It isn't enough to meet or barely surpass specifications—not when it is possible to build maximum performance into power cable—as Circle does. Take, for example, the IPCEA-NEMA 60 cycle water absorption test.

Circlesheath® Type RR Power Cable Performance

In the IPCEA-NEMA "Accelerated Water Absorption Tests," Section 6.9, a sample of power cable is immersed in 50°C water for a period of 14 days during and after which time specific inductive capacity and stability factor are measured.

Not only does Circle butyl-insulated power cable far surpass all minimum specifications after 14 days immersion—*but continues to do so after one year and eight months of continuous immersion. And the test is still going on!*

Date of original immersion: September 1958 **Date of last test: April 1960**

CABLE DESCRIPTION: 15KV, UNGROUNDED, SHIELDED	CIRCLESHEATH® CHANGE SIC	PERFORMANCE STABILITY FACTOR
700,000CM	4.3%	.6%
300,000CM	3.9%	.5%
300,000CM	3.6%	.4%

IPCEA-NEMA Requirements: Change SIC 1 to 14 days: 5% max.— stability factor after 14 days: 1% max.

Circle's school for production men means better products for wire and cable users. Here laboratory technicians lecture on such subjects as extruding techniques, optimum operating speeds, testing procedures, etc.

The manufacture of high-reliability power cable is no accident. It requires expert knowledge of compounding techniques, absolute quality control—and production men who not only care enough . . . but *know enough* to produce the very best.

CIRCLE **WIRE & CABLE**
a subsidiary of
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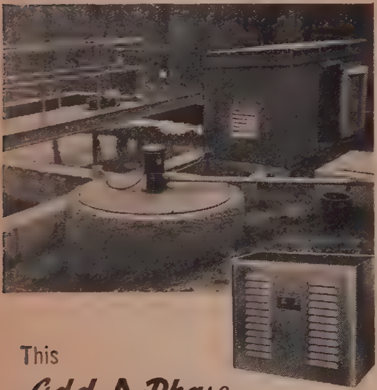
RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE •
PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT

★ "MARKETS UNLIMITED" ★

"WE ELIMINATED
$3800.00
IN 3-PHASE WIRING
with the
Add-A-Phase®"

Says RUSS JONES
RUSS JONES CONSTRUCTION CO.
ST. LOUIS BUILDER

"The ADD-A-PHASE enabled us to operate this 3-phase equipped SANITARY SEWAGE DISPOSAL PLANT FROM SINGLE PHASE LINES"



This Add-A-Phase Power Converter is successfully operating the following 3-phase equipment from single phase lines

- 2 H. P. BLOWER
- 1 H. P. AGITATOR DRIVE
- 1/3 H. P. SUMP PUMP

Add-A-Phase units are available for 1 H.P. to 50 H.P. three-phase motors . . . write for more information.

ADD-A-PHASE Dept. ECM
Div. System Analyzer Corp., Nokomis, Illinois

Gentlemen: Please send, without obligation, complete details on your ADD-A-PHASE Power Converter.

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SEE FOR YOURSELF . . . package includes many case histories of the success of the Add-A-Phase . . . years of trouble free use. IF YOU HAVE A SPECIFIC ELECTRIC POWER PROBLEM GIVE US THE DETAILS FOR RECOMMENDATION.

FRANK CASE, F. W. Kiemle Co.; Toledo, Ohio; F. R. Pisano, Penn Electric Motor Co., Philadelphia, Pa.; Al Kinney, Kinney Electric, Marysville, Calif.

Effective April 1, 1961, the association will be known as the Electrical Apparatus Service Association—a name change that has won majority approval of members and the Board of Directors.

Future annual conventions are scheduled for Denver in 1961, San Francisco in 1962 and Chicago in 1963.

Final Ideas Contest Winners

Announced winners of the 1959-60 NISA Ideas Awards Contest were the following:

Fred A. Robinson, Frederick A. Farrar Co., Keene, N. H.—First prize of $125 for a connecting tool designed to make curl-wound connector clips.

J. P. Waddell, Decatur Electric Service Co., Decatur, Ala.—Second prize of $100 for a tool designed to remove impeller stems and shafts from jet pump motors.

W. G. Bedoit, Chattanooga Armature Works, Chattanooga, Tenn.—Third prize of $75 for an indicating chart for connecting 3-phase, wave-wound rotors in four simple operations.

Peter Herman, Electric Motor Service, Ltd., Regina, Saskatchewan, Canada—Fourth prize of $50 for design of a tool for knurling bearing housings and rotor shafts.

Robert F. Janos, MQN Electric Motor Service, Mentor, Ohio—Fifth prize of $25 for a method of applying plastic compounds to repair and buildup bearing housings.

Anthony Bruno, Sandman Electric Co., Inc., Boston, Mass.—Sixth prize of $15 for design of a simple rotor lifting device.

Richard Lierer, Queens Electric Motors, Inc., Jamaica, L. I.—Seventh prize of $10 for a safety chain handle on a motor dolly.

NFPA Electrical Section Meeting

The annual meeting of the Electrical Section of the National Fire Protection Association was held May 16 at the Queen Elizabeth Hotel in Montreal, Canada.

M. M. Brandon, president, Underwriters' Laboratories, Inc., and chairman of the Electrical Section, presided. In Mr. Brandon's report, he related the activities of the Electrical Section for the past year. The most important accomplishment was the final adoption and distribution of the 1959 edition of the NEC. Mr. Brandon also explained the proper procedure for obtaining an official interpretation of code rules, and how interpretations are decided.

Following Mr. Brandon's report, Frank Stetka, Electrical Field Service Engineer, NFPA, and secretary of the Electrical Section, explained his activities for the past year. Much of his time was devoted to NEC activities, which included considerable traveling in all parts of the country to meet with electrical groups on code problems.

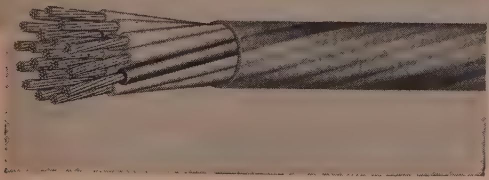
The balance of the one-day meeting was devoted to representatives of a number of NFPA-related standards committees. These standards supplement many of the electrical requirements of the NEC.

H. H. Watson, member of the NFPA Committee on Trailers and Trailer Camps, gave a report on the wiring of mobile homes as covered in the proposed NFPA Standard No. 501A. He stated that

C. E. SMITH, J. E. Berger Co., Detroit, Mich.; Jack Romanoff, Ontario Equipment Co., Toledo, Ohio; and Dick Romanoff, Romanoff Electric Motor Service, Toledo, Ohio, at NISA convention in Miami Beach.

General Electric Silicone Rubber Insulation chosen for Dresden Nuclear Power Station

Excellent moisture and heat resistance, protection against gamma radiation



Silicone insulated control cable used in Dresden nuclear power station. Cable extends from fuel rod position indicators at the bottom of the control rod drives below the reactor to a local panel within the enclosure.
Silicone insulated cable supplied by General Electric Wire and Cable Department.

Because it combines many desirable properties, particularly a combination of heat and radiation resistance, General Electric silicone rubber insulation is being specified for control and power cable in atomic reactors and other nuclear power generation equipment.

G-E silicone rubber also provides a more reliable and efficient cable insulation for many other electric utility and industrial applications. Among its many advantages are the following:

Excellent Heat Resistance: In power cable applications, offers long service life at temperatures up to 150°C; overload temperatures to 225°C; short-circuit overload temperatures even higher.

Extra Current-Carrying Capacity: As a result of its excellent heat resistance, cable insulated with G-E silicone rubber can carry up to twice the current as can conventional cable of the same size.

Low Moisture Absorption: Easily withstands moist operating conditions that may cause other insulations to fail.

High Ozone Resistance: Ozone and corona, which cause rapid aging of organic rubber, have negligible effect on silicone rubber.

Low Temperature Flexibility: Class 900 electrical grade G-E silicone rubber stays flexible at temperatures down to −60°C, special grades to −100°C.

Radiation Resistance: G-E silicone rubber insulation will withstand gamma radiation up to 1×10^8 roentgens, about 20 times higher than fluorine-containing insulation.

For more facts and figures on G-E silicone rubber insulation, write General Electric Company, Silicone Products Department, Section DD1213, Waterford, New York.

GENERAL ELECTRIC

SILICONE PRODUCTS DEPARTMENT

Section DD613, Silicone Products Department
General Electric Company, Waterford, New York

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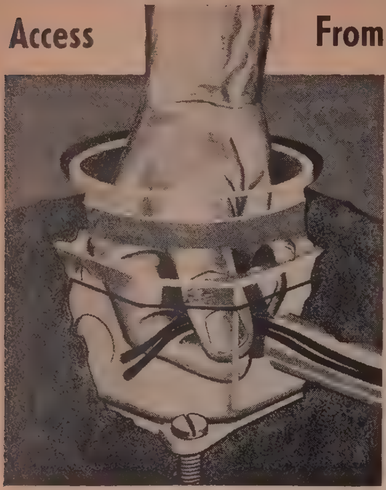

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to bottom of BOX

This #190 "Tru-Level" series is a standard 4 inch octagon, sheet steel box, developed for concrete or tile floors, also wooden floors with concrete base.

A threaded brass adjusting-ring permitting ½ inch height adjustment, in addition to three screw legs 2½ inches long, make for quick and easy tru-leveling.

Conduit attachment or wire-pulling is easy even when concrete is poured to very top of box. The 3¼ inch opening in the box-body permits whole hand access from top of concrete to bottom of floor box.

Designed to fit all popular size and style receptacles—simply clip off plaster ears and drop into place.

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284-S

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ACCESSORIES

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The 284-S Duplex Receptacle Nozzle comes with ½" brass pipe extension or can be furnished with ¾" pipe.

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J. E. HURT, Industrial Electric Equipment Co., Dallas, Texas; and A. D. Ludke, Ludke Electric Co., Inc., Vicksburg, Miss. relax between sessions at NISA convention in Miami Beach.

mobile units of the residential type are to be classified the same as one-family dwellings, and that all wiring within the trailer should comply with the applicable standards of the NEC. It is proposed that the next edition of the NEC will contain a cross reference to the new trailer standard for such special considerations as portable cord supply, grounding, and standardization of cord and receptable sets. Other proposals include a minimum capacity of 50 amps for cord sets supplying mobile homes, except where the load does not exceed 2400 watts, in which case 30-amp cord sets will be permitted. Where the load capacity of an individual mobile home will be from 51 to 100 amps, two separate 50-amp cord sets will be required, with each supplying individual load centers in the trailer. If the load requires a capacity of more than 100 amps for an individual trailer, standard NEC services will be required. Another feature in that the neutral must not be grounded within the trailer, and a separate grounding conductor must be provided for grounding purposes.

Roy Hudenburg, chairman, NFPA Committee on Hospitals, gave a report on the proposed requirements for hospital emergency electrical systems, which will be included in a new NFPA Standard—No. 76T. Mr. Hudenburg stressed the increasing need of maintaining electrical service to vital equipment and areas in hospials. He pointed oue that the new standard will include sources of power, emergency and critical classifications, electrical characteristics, arrangement of wiring, generator sets and prime movers, and maintenance of equipment.

Trends in Distribution Analyzed at PCEA Conference

The Engineering and Operating Section of the Pacific Coast Electrical Association held its annual conference in Berkeley, Calif., March 31-April 1, at which time ten separate interest-groups held parallel sessions to discuss more than 80 subjects during their crowded two-day meeting. Particularly interesting were presentations pertaining to underground and overhead distribution, substation design, and system operation.

Under the first-named category, Jack B. McKee, Wagner Electric Corp., maintained that underground distribution for residential areas would result in improved appearance of an area, fewer service interruptions, lower maintenance costs, greater safety, and longer life, although installation charges would be greater, as would expenses related to outages and repairs if they became necessary. He specified that direct-burial conductors should connect with service pedestals and boxes rather than with manholes or handholes, and that sharing a trench with the telephone company could reduce installation costs considerably.

Through the medium of numerous excellent slides, he illustrated recommended methods for establishing loop systems involving the use of pad-mounted transformers having provisions for primary sectionalizing. He emphasized the fact that semi-buried vaults could involve problems concerning water accumulation, inadequate electrical clearances, difficulties in replacement of transformers when load growth dictates greater capacity,

STANLEY KROELL, Kroell Electric Co., Canton, Ill.; and W. W. Hendricks, Hendricks Electric Co., Peoria, Ill., attended NISA annual convention in Miami Beach.

LPI Trend luminaire provides high-level illumination at the work surface with engineered brightness control. In a typical installation with a white ventrolens diffuser, brightness on desks is only 800 footlamberts compared to brightness of 2100 footlamberts for a conventional baffle-type unit in the same installation.

New LPI Trend luminaire provides high-level illumination, meets recommendations for visual comfort

Visual comfort at high illumination levels is now attainable in schools and offices with the new, economical LPI Trend series.

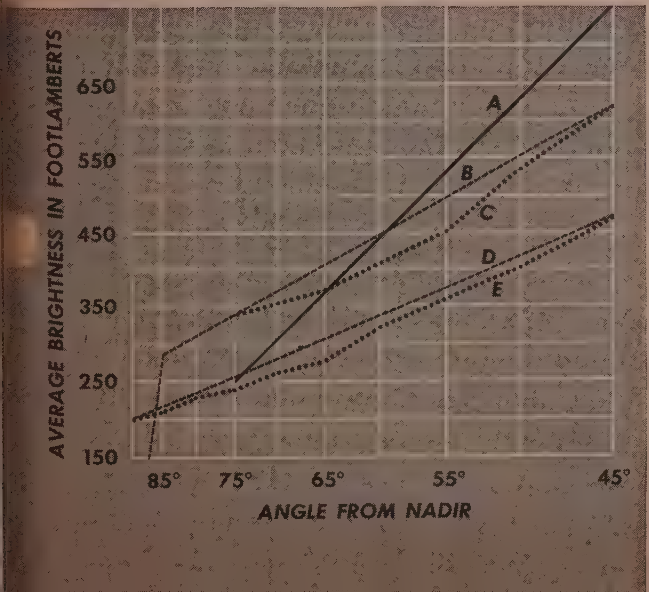
The design of the Trend luminaire combines luminous side panels with efficient diffusers. Both are engineered in shape and transmission characteristics to provide increased foot-candle levels while closely approximating the Illuminating Engineering Society's "scissor curve" for visual comfort.

The new design with luminous, wrap-around side panels makes the Trend luminaire efficient and attractive. Direct glare is well below levels commonly associated with conventional fixtures. The series offers a choice of three types of diffusers—clear ventrolens, white ventrolens to achieve minimum reflected glare, and a new polystyrene egg crate louver which provides 55° shielding both crosswise and lengthwise.

Trend series luminaires are offered in the following sizes for 430 ma rapid-start lamps: 4 ft. x 12 in. unit for two lamps; 8 ft. x 12 in., tandem arrangement for four lamps; 4 ft. x 16 in. for four lamps.

Visual comfort of the new Trend luminaire is depicted in the adjoining chart according to the "scissor curve" method recommended by the Illuminating Engineering Society. Average brightness levels are obtained in the crosswise and lengthwise directions at angles between 45° and 90° from nadir and are plotted on a chart. Also plotted is a straight line representing the I.E.S. recommended brightness limit and straight lines representing the luminaire's own brightness limits in the two directions. Because brightness measurements of the Trend luminaire in the critical crosswise direction fall below these lines, the luminaire may be said to meet I.E.S. recommendations for crosswise brightness control. Lengthwise measurements closely approach these recommendations and are well within the comfortable range.

For complete information on these attractive, moderately priced luminaires, write for LPI's Trend Bulletin.



LPI FLUORESCENT LIGHTING

Lighting Products Inc., Highland Park, Illinois

Plot of average brightness in footlamberts in plane normal to lamps (crosswise of luminaire) and plane parallel to lamps (lengthwise of luminaire) for pendant-mounted LPI Trend luminaire—Catalog No. 7840-4, with CBM ballast and two F40T12/CW/RS lamps

A—*I.E.S. recommended brightness limit (75°-45°)*
B—*Trend luminaire brightness limit—lengthwise*
C—*Trend luminaire average brightness—lengthwise*
D—*Trend luminaire brightness limit—crosswise*
E—*Trend luminaire average brightness—crosswise*

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RLM STANDARD 40
REFLECTORS
FOR 400 W. MERCURY and 300-1500 W.
MOGUL INCANDESCENT LAMPS

These etched Alzak Aluminum Reflectors are the medium spread type designed with 33 degrees light cut-off. With 400 W. Mercury Lamps, they deliver 50% output in the 0-30° zone. With incandescent lamps they put 59% in the 0-30° zone. They incorporate ventilation with a protective drip shield. Interchangeable hoods for various lamp sizes place the light center correctly in the reflectors. Hoods are finished white or gray porcelain enamel.

WHITE
PORCELAIN ENAMEL

Same design as Alzak, finished all white porcelain enamel, 16" and 18" diameters. Socket or Easy-Tach construction for pendant or box type mounting. Send for descriptive literature on these units today.

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Dept. 63, 32 S. Peoria St., Chicago 7, Ill.

C. W. TANNER, Industrial Motor Service, North Tonawanda, N. Y.; C. C. Worth, Erie Electric Co., Inc., Buffalo, N. Y.; and Frank Wurth, Wurth Electric Motor Co., Woodhaven, N. Y., compare notes at NISA's Miami Beach convention.

and the derating of transformers due to inadequate ventilation and high ambient temperatures. He also urged the development and acceptance of industry standards so that manufacturers could intelligently arrange production schedules to meet specific requirements of customers.

On the same general subject, H. D. Dillon, San Diego G&E, stated that management would be definitely interested in considering an underground system if it would provide satisfactory service at reasonable rates; be reasonably secure from extensive outages; permit necessary maintenance without undue difficulty; and be sufficiently flexible to meet the expected growth of the future. Should these objectives be accomplished, he claimed that utility management would have no hesitation in meeting public desires for installation that would eliminate esthetic objections related to present overhead lines.

Considerable factual data on underground-overhead cost comparisons were presented by R. C. Blankenburg, Southern California Edison Co., who based his conclusions upon a study showing the influence of primary voltage levels and transformer spacings on a per-lot basis. This study reflected great accuracy and included numerous points of comparisons, including underground residential systems based upon 4-kv wye, 12-kv delta, and 832/480 volts delta supplied from local 12-kv banks; diversified demand values of 2½, 5 and 10 kva per customer; vault-type and pad-type systems, with seven basic plans ranging from 4 to 36 lots per transformer.

In this analysis he concluded that 12-kv delta is the best all-round choice and 4 kv the most costly within the scope of the studies; 8 lots per transformer is the best choice for pad-type construction, with transformer spacing somewhere between 8 and 24 lots for vault-type systems. In this informative review, Blankenburg considered such factors as material costs, labor rates, overhead and supply expenses, all losses occurring in local area systems, numerous system types, ducts and cables, trenching, sectionalizing facilities, various terrain and tract plans, demands and diversity, primary circuit areas, service details, and connections.

Another paper concerning underground systems pertained to testing of cables, a criteria that advocated dc testing equipment because of compactness and ready portability. As described by Elrino E. Neher, PG&E, such equipments consist of manually controlled voltage regulators, transformers, suitable rectifiers, capacitors, and switches and by cutting in a timer switch which would discharge the high-voltage capacitors into the cable, this machine could also function as an impulse generator for locating faults.

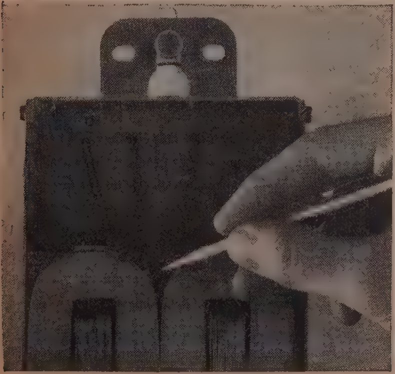
In this discussion it was also mentioned that migration of moisture into cable insulation accounts for most cable failure, and that fractures resulting from electrolysis, contraction and expansion, metal fatigue and abrasion are the most common causes of cable sheath failure.

Speaking before the Overhead Distribution group, A. S. Anderson of Ebasco Services discussed the status of the EEI-NEMA committee considering higher-voltage sys-

A. D. COPPINGER, Coppinger Machinery Service, Inc., Bluefield, W. Va.; E. H. Wheat, Wheat's Electric Motor Repair, Watertown , S. D., and R. R. Dumbaugh, Dumbaugh Electric Repair Shop, Butler, Pa., at NISA's Miami Beach convention.

NEW POTTED INDUSTRIAL TRANSFORMER STOPS MOISTURE DEAD!

LONGER USEFUL LIFE WITH 100% COIL AND CORE SEALING . . . IMPROVES PERFORMANCE, ELIMINATES MAINTENANCE OF WESTINGHOUSE UNIT



Westinghouse developed a silica-filled resin compound for completely encapsulating the core and coils of this industrial transformer. The unit is absolutely impervious to moisture and water-laden industrial atmospheres.

This compact, lightweight transformer is easy to mount . . . can be mounted in *any* position. Attractive appearance and low noise level permit installation of unit *anywhere* without objection. No transformer hum to distract workers.

All Westinghouse "EP" transformers bear the UL label. Available in ¼-, ½-, ¾-, 1-, 1½- and 2-kva ratings at 600 volts and below for lighting, small motor loads and the like. For larger load applications, "EP" single-phase units are rated 3 to 10 kva, 5000 volts and below for *indoor* service . . . 3- to 15-kva transformers, 600 volts and below for indoor-outdoor installations. Also available in 3, 6, 9 and 15 kva, 600 volts and below, three phase for indoor-outdoor applications.

Units also available in ratings for auto and buck-boost applications.

Convenient stocks of the Westinghouse "EP" dry-type transformer are stocked throughout the U.S. Contact your Westinghouse sales engineer for complete data on the "EP" line or write Westinghouse Electric Corporation, P.O. Box 231, Greenville, Pennsylvania. J-70938-R

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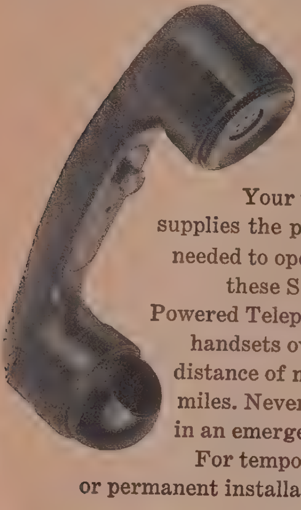
PHONES
that need no current



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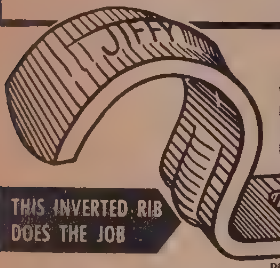
JIFFY
THIS INVERTED RIB DOES THE JOB

Also available without mounting hole for use with gun.

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Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

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NEW JERSEYITES have after-session discussion at Miami Beach NISA convention. They are: (L to R) J. D. Mayes, John C. Dolph Co., Monmouth Jct.; Edward Scudder and G. R. Lockwood, Lockwood's Electric Motor Service, Trenton; and C. W. Davall of the John C. Dolph Co. at Monmouth Junction.

tems for residential areas, and also presented some basic reasons why 240-volts-to-neutral systems, both single- and 3-phase, are preferred over 265/460.

There is general agreement that 240/480-volt systems are more economical when considering utility costs in primary, transformers, secondary wires and services, he stated, but even when studies are made from the viewpoint of customers' costs, the use of autotransformers with 240/480 systems becomes more economical than 120/240-volt systems whenever a customer's undiversified demand exceeds 11 kva.

He also stated that one large manufacturer of appliances claims that there should be little or no extra cost for operating large appliances at 240 volts to neutral and that this higher voltage level need not constitute an extra hazard to homeowners if metallic bodies of appliances and tools are grounded, or if double insulation is specified. Whatever is done to reduce bodily contact with an energized wire or metallic surface, while another part of the body is in contact with ground, would cost the same at either of the higher voltages, he continued, and the end result would be more effective than keeping the voltage at its present, lower level.

Another interesting talk before this same group discussed knowledge of inhibitors gained through compression connector tests. This subject, developed by W. W. Olive, Jr., project engineer for the James R. Kearney Corp. of St. Louis, Mo., reviewed generally held opinions concerning inhibitors which are recommended for use with bimetallic connections, then drew attention to the common practice of adding conducting metal particles as a current carrier between conductor and connector. He also mentioned that wire-brushing an aluminum conductor to remove oxide film is generally appreciated, but how about cleaning internal grooves in the connector body, or the hole in a service entrance sleeve? Surely oxide has formed here as well, he declared, although wire-brushing these surfaces would be difficult if not impossible.

Sacrifice and compromise are deterrents to an ideal inhibitor, he continued, citing electrical efficiency gained at the expense of rubber compatibility; an excellent sealer with an unfavorable thermal range; exotic chemicals in quality with correspondingly high costs. In these and other instances, sacrifices and compromises are made, the result being that today's inhibitors are not perfect and considerable improvement is still possible in both application and use of inhibitors on all conductor connections.

The application of aerial lifts to overhead line construction and maintenance, as analyzed by P. C. Oldershaw of PG&E's operations department, equated increasing costs of materials and labor to the growing use of modern tools, methods, and power-operated devices designed to lessen the labor element involved and to permit 2-, 3- or 4-man crews to handle jobs formerly requiring much larger crews.

One such device is the aerial lift, he said, citing numerous examples where they had been used successfully on overhead bus construction and maintenance, installing street lights, stringing wire over and around obstructions, and work on

E. E. KOLHONEN, Peabody Electric Motor Co., Peabody, Mass.; Hector Munro, New England Machine & Electric Co., Pawtucket, R. I.; and W. M. Hogue, Larsen-Hogue Electric., Los Angeles, Calif., enjoy coffee break at NISA convention in Miami Beach.

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WIRE and CABLE Casebook

1st Quarter, 1960

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Neoprene jacketing for electrical cable has gained wide acceptance primarily because of its durability. Manufacturers and users alike have found that neoprene's resistance to weather, ozone, mechanical abuse, flame, oils, chemicals, and wide temperature variations means long, useful life for the cable they make and use.

Probably the first commercial use of neoprene in wire and cable was as a protective covering for lead-sheathed paper insulated power cables. Initial work with such coverings began in the early thirties. In 1937, neoprene jackets were first used on non-metallic sheathed stationary power cables. Neoprene jacketed ignition wire was introduced to the automotive industry that same year.

Other applications for neoprene jackets soon followed. The first control cable and telephone drop wire to use neoprene jackets were introduced in 1940. Then, in rapid succession, came portable power cables, weatherproof line wire and service drop wire, appliance cords, A. C. secondary network cable, aerial cables, building wire . . . all with jackets of Du Pont neoprene.

But what about neoprene's insulation value? Electrical properties of neoprene (Figure 1.), while inferior to most commonly used insulating materials, have been proven more than satis-

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Utility engineers, electrical contractors and plant engineers will find the new *Wire and Cable Casebook* a valuable source of information. It documents neoprene's quarter century of service in the electrical industry, combatting weather, sunlight, aging, flame, ozone, corona, heat, oil, grease and mechanical abuse. Detailed reports of successful long-term applications . . . overhead and underground . . . show you why industry has put its confidence in neoprene-jacketed cable.

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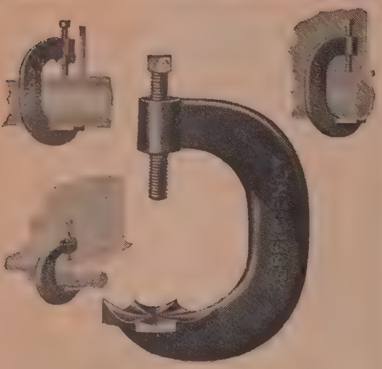

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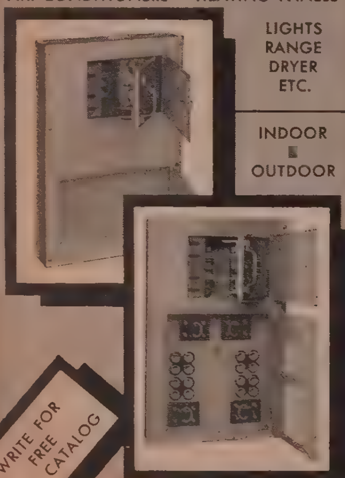

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GEORGIANS Frank McGee, McGee Electric Co., Rome; and John R. Guest, Tifton Electric Motor Shop, Tifton, relax with coffee between sessions at NISA convention in Miami Beach.

aerial taps. He also discussed a special telescoping type lift used by his own company whereby a man could be placed in working position by a 50-ft boom and cage-platform mounted on a suitable truck with weight distribution arranged so the unit would remain mobile with the lift in any workable position. It is estimated, he concluded, that an aerial lift operated by a 2-man crew can, on an equivalent-time basis, replace a 5-man crew on new work of the types he discussed.

Power Line in Grand Canyon; Higher Secondary Voltages

Discussed by George Carline of the Arizona Public Service Co. was a new, nearly invisible 12-kv 2½-mile power line extending from the rim of the Grand Canyon to the base, replacing a deteriorated 2400-volt cable for powering a pumping station 3000 ft down in the gorge. Since the line would not be accepted if it were visible from any scenic viewpoint on the canyon rim, every effort had been made to select sites with dark backgrounds. Black creosoted poles and single crossarms were used, while ACSR cables were covered with black plastic to keep the bright new metal from reflecting sunlight. To transport materials and men into the canyon, helicopters had been used most effectively, initial surveys for pole sites and cable routing having been initially plotted on muleback.

N. E. Weber of the Southern California Edison Co. presented new ideas in the development of substations, using aluminum structures and conductors. This presentation indicated that such structures give satisfactory service, and that no appreciable deflections have developed to recommend either changes in selection of equipment initially specified or increases in the quantity of aluminum required. It was also noted that aluminum has resisted corrosion satisfactorily and now remains much the same as when erected about nine months ago.

Weber added, however, that his report did not include results of severe winter weather which could possibly affect corrosion; neither did it show any appreciable construction savings, inasmuch as the amount of field bolting was the same as that required for galvanized steel structures.

Californian Maintenance Group Launches Long-Planned Expansion Program

The Electrical Maintenance Engineers Association of California, which for 22 years has rendered outstanding service to the industry in the Los Angeles area, took a major step towards its long-planned goal of establishing a state-wide association when it recently held a branch-chapter organizational meeting in Antioch, Contra Costa County (just inland from the mushrooming San Francisco Bay area).

On hand to discuss objectives and former program patterns of EMEA were three past-presidents: Charles Hays, Electrical Estimators, Inc., Los Angeles; Jack Singleton, Pacific Coast Steel, Hayward; and Emerson W. Reichard of Sacra-

AT ORGANIZATIONAL MEETING of north-California EMEA group, held in Antioch, General Chairman Floyd McNeil of Western California Canners (center) received literal and physical backing from three former presidents of the parent organization: Emerson S. Reichard, Sacramento, now retired from EE consulting work; John J. Singleton, Hayward, Pacific Coast Steel; and Charles H. Hays, Los Angeles, The Electrical Estimators.

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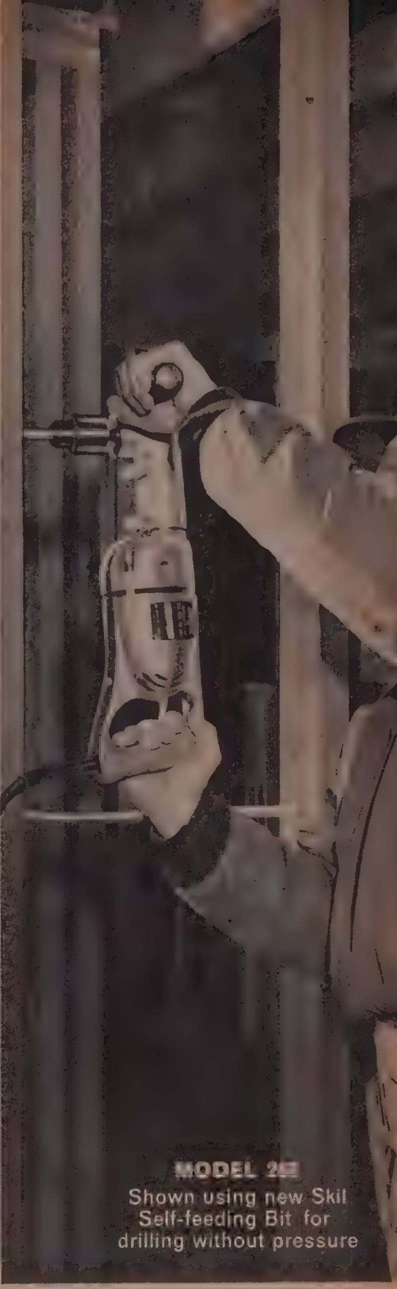
Shown using new Skil Rotary
Bit for fast masonry drilling

MODEL 78
Shown using shatterproof
Skil Hole Saw



MODEL 2[illegible]
Shown using new Skil
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Skil ¼″ Model 243 Drill has "in line" rear handle for better control and direct application of pressure. Powered and geared for rugged day-in and day-out drilling in metals, masonry, tile, wood. Saves replacement costs of bits that often break or dull under the strain of stalling in less powerful drills.

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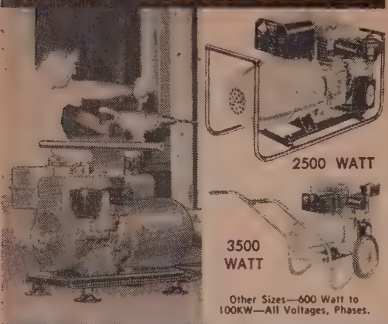

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mento, now retired. Present at this initial meeting were 61 enthusiastic electrical maintenance men, contractors, service shop operators, distributors, utility and manufacturer representatives, some of whom had traveled over 400 miles to attend.

As first General Chairman for this new division, Floyd McNeil, chief electrician, Western California Canners, announced that future committee activities would be directed by Ed Ober, programs; Manuel Gularte, attendance; Ken Scofield, Pacific Electric Motors, membership; Lee Wachs, The Electric Corp., exhibits; Dan Kirby, H. K. Porter Co., Thermoid Div., Pioneer Works, welfare; Jerry Moss, Western California Canners, "electro factus," and Stan Barton, raffles.

Preliminary thinking regarding organization activities, plant visitations, open discussions regarding maintenance methods, instruction groups, and an up-coming electrical show received favorable response, while brief talks by the three past presidents concerning EMEA's history and highlights added interest to this gathering.

NISA News

Shops shouldn't rely too much on a customer's credit references, a Dun & Bradstreet man told members of NISA's Chicago Chapter recently. Some firms refer prospective creditors only to the companies that would rate them as good risks, D. L. Megchelson told members attending the April 12 meeting at Hotel Graemere.

• • • •

A number of NISA chapters have held elections since last month, and the following new officers have been chosen:

Connecticut Chapter: President, Al Lebowitz; Mike Smaga, vice-president; secretary, Ed Piteo; treasurer, Frank Johns; directors, Mike Phillips, Joe Piela, John Morrell, Lou Sweeney.

King Coal Chapter: President, George Byars; vice-president, Hal Lundemo; secretary-treasurer, Richard Lottes; directors, Rex Woodward and Frank Flanders.

New England Chapter: President, Bob Bedig; vice-president, Bob O'Day; treasurer, Brent Smith; secretary, Hector Munro; director, Charles Zalewski.

Niagara Chapter: President, George Novas; vice-president, Chet Tanner; treasurer, John Grzebinski; secretary, Ed Capacefalo.

Ontario Chapter: President, Bert Weale; secretary, Jack Belanger; treasurer, Ted Waffle.

Oregon Chapter: President, Marshall C. Yeager; vice-president, Jack Calhoun; secretary-treasurer, Roy W. Van Ottingham.

Western Michigan: President, Pat Cook; vice-president, Charles Ferguson; secretary-treasurer, Mel DeYoung.

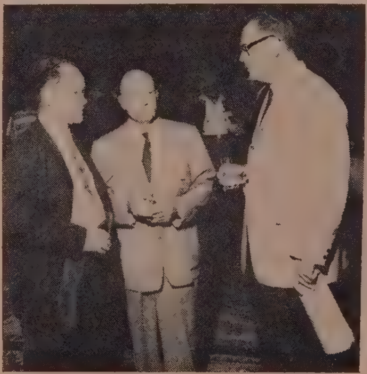
• • • •

The name of NISA will become Electrical Apparatus Service Association on April 1, 1961. Overwhelming approval of the membership was voiced in a mail ballot, supporting the actions taken by the board of directors and the chapter officers last fall.

• • • •

A number of state and regional meetings are being planned by electrical apparatus service shops, including these:

A state meeting on September 18,



TEXAS HUDDLE, during NISA Miami Beach convention sessions composed of: (L to R) H. J. Witcher, Lubbock; H. W. Hargis and A. M. Grayson, Jr., Dallas; all of the W. M. Smith Electric Company.

DETROIT SHOP MEN C. R. Medsker, Miller-Seldon Electric Co.; and O. B. Palmer, Palmer Electric Co., Inc., find time for private conference during NISA convention in Miami Beach.

NOW IN BOOK FORM!

"CONSTRUCTING ELECTRICAL SYSTEMS"

In their May 1960 issue, the editors of ELECTRICAL CONSTRUCTION AND MAINTENANCE published an exclusive manual, more than 100 pages in length, on the selection and installation of electrical equipment in modern systems for power, light, heat, signals and communications.

Now this presentation is available as a full-length, hardcover book!

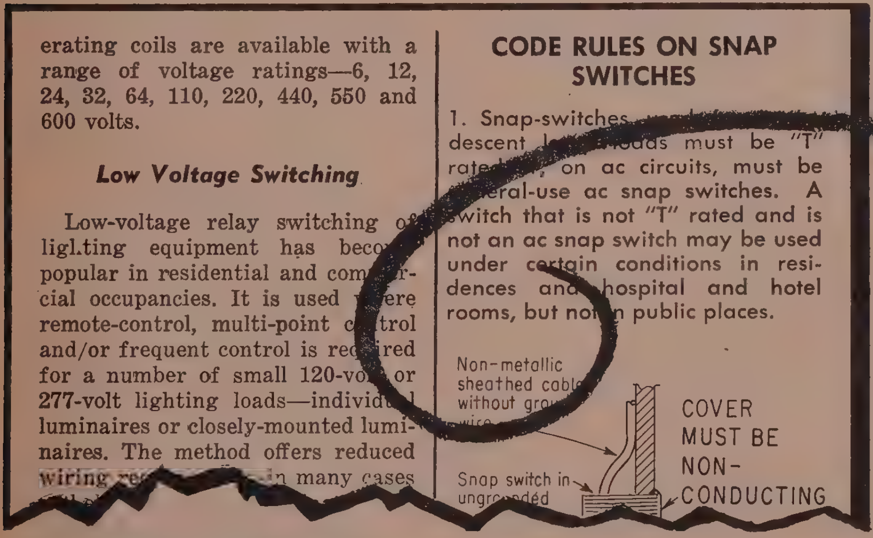
Here is an authoritative reference for electrical contractors, consulting electrical engineers, plant electrical men, electrical inspectors and architects, and electrical wholesalers.

This book explores the no-man's land between points where the design engineer's responsibility ends, and the installer's begins. Here important decisions must be made—construction decisions by the designer, and design decisions by the constructor. Now, for the first time, electrical men can turn to a source of practical guidance on constructing all types of electrical work: commercial, industrial and institutional!

The data included represents the most advanced engineering practice. Special emphasis is placed on requirements of the National Electrical Code regarding placement, mounting and connecting of system components.

Photos and diagrams are used throughout the work to illustrate construction details and Code provisions.

Your copy of **"Constructing Electrical Systems"** will pay for itself many times over by providing quick, sure solutions to the multitude of problems involved in any electrical construction job—and by helping you avoid conflicts and delays concerning Code interpretations. Order today . . . just fill in and mail the coupon!



erating coils are available with a range of voltage ratings—6, 12, 24, 32, 64, 110, 220, 440, 550 and 600 volts.

Low Voltage Switching

Low-voltage relay switching of lighting equipment has become popular in residential and commercial occupancies. It is used where remote-control, multi-point control and/or frequent control is required for a number of small 120-volt or 277-volt lighting loads—individual luminaires or closely-mounted luminaires. The method offers reduced wiring [illegible] in many cases

CODE RULES ON SNAP SWITCHES

1. Snap-switches [illegible] descent [illegible] loads must be "T" rated [illegible], on ac circuits, must be general-use ac snap switches. A switch that is not "T" rated and is not an ac snap switch may be used under certain conditions in residences and hospital and hotel rooms, but not in public places.

Non-metallic sheathed cable without gro[illegible]
Snap switch in ungrounded
COVER MUST BE NON-CONDUCTING

For easy reference, interpretations of the National Electrical Code appear in the book adjacent to the discussion to which the Code provisions apply.

CONTENTS

- General Considerations
- Luminaires and Lighting Equipment
- Motors and Controllers
- Conductors
- Raceways
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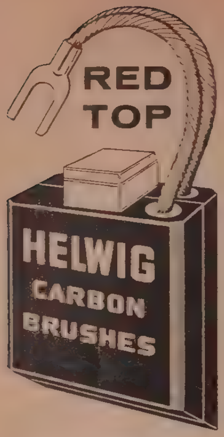

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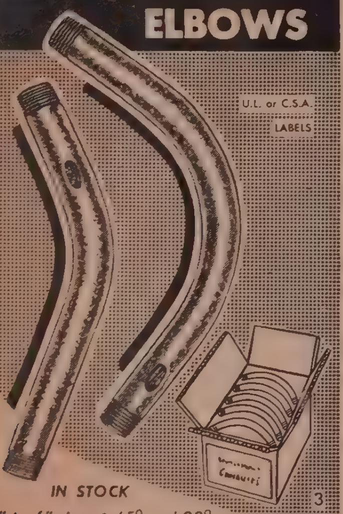

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possibly in Columbus, of Ohio shops. Arrangements are being made by members of the Central Ohio Chapter.

A meeting in Minneapolis on September 16-17 of members of the North Central, Midwestern and Wisconsin chapters.

Meetings of the King Coal Chapter on July 14 in St. Louis; on October 13 in Evansville, Ind.; and on January 12, 1961, in Mount Vernon, Ill.

• • • •

A record 57 members and guests attended the April 19 meeting in Oshkosh of the Wisconsin Chapter. Twenty-six were prospective members. They heard Seymour Crumpler of Franklin Electric Co. discuss the servicing of submersible pumps.

• • • •

Southwestern Chapter was recognized recently by the Association Institute's Newsletter for its "Member-Grams" which are used to stimulate membership applications.

• • • •

A charter to the new Tri-State Chapter of NISA, which includes shops in the greater Pittsburgh area, and parts of Ohio and West Virginia, was granted by the board of directors of NISA at the Miami Beach meeting in May.

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A gain of 46 members was reported by NISA for the year ending March 31, 1960. Total active membership (motor shops) is 1504. Associate and privileged (retired) memberships bring the grand total to 1602.

• • • •

Fifty-two members and guests attended Los Angeles Chapter's meeting on April 12 at Michael's Restaurant. A "Ladies' Night" is scheduled for June.

• • • •

Stanley Jay, of Electric Motor & Control Co., has been admitted to associate membership in the Central Ohio Chapter.

New Books

Practical Residential Wiring, by John F. Nowak. 511 pages, $7.95. D. Van Nostrand Co. Inc., Princeton, N. J.

New revision of practical book gives extensive information on all aspects of home wiring including circuiting, tools and splicing, plan reading, wiring methods, testing, and trouble-shooting. A chapter is devoted to estimating electrical installations for small-house wiring; National Electrical Code tables are given in a glossary.

Industrial Electronics in Questions and Answers, by Edward J. Bukstein. 197 pages, $3.95. Frederick Ungar Publishing Co., 105 E. 24th St., New York 10, N. Y.

A practical book covering resistance welding and photoelectricity, thyratrons, time-delay circuits, counters, scalers, and test instruments. Data is presented in the form of question and answers, beginning with the most elementary and progressing to a complete explanation of the circuits involved.

Fundamentals of Electricity, by Calvin C. Bishop, 230 pages, $6.95. Chilton Co., Book Div., 56th and Chestnut Sts., Philadelphia 39, Pa.

A reference book for technicians and engineers. More advanced than most basic texts, this book provides mathematical analyses and backgrounds for each phase covered. General categories include early investigations and basic discoveries, methods of generating electricity, units of measurement, magnets, ac circuits and apparatus, dc motors and generators, batteries and electrolytes, electronic principles, and discoveries in nuclear science.

Modern Electronic Components, G. W. A. Dummer. 472 pages, $15.00. Pitman Publishing Corp., 2 West 45th St., New York 36, N. Y.

A comprehensive survey of the characteristics of the more common components used in today's electronic equipment. Profusely illustrated, the book covers such equipment as fixed and variable resistors, fixed and variable capacitors, wires and cables, plugs and sockets,

INTEREST in electric heating equipment and market potential brought Pittsburgh contractors: (L to R) Thomas Hanlon, Hanlon Electric Co.; Paul D. Lucas, Kelly-Ashby Electric Co., New Kensington, Pa.; and W. E. Walter, Fort Pitt Electric Construction Co., to recent NEMA Electric House Heating Symposium in Chicago.

FINAL CHECK on code interpretation is made by contractor Ernie Kanten (left), Ortonville, Minn., as he discusses evening codes session with state electrical inspector Vernon Christensen of St. Paul, at recent Upper Midwest Electrical Convention in Minneapolis.

relays, switches, inductors, transformers, and transistors. Additional chapters cover effects of vibration, shock and nuclear radiation, testing methods, possible faults, and packing and preservation.

Two-Way Mobile Radio Handbook, By Jack Helmi. 208 pages, $3.95. Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 6, Ind.

A comprehensive treatment of the rapidly growing mobile radio field. Chapters cover basic systems, types of receivers available, transmitters, control systems, antenna systems, power supplies, and servicing, supplemented by photographs, block diagrams, and equipment schematics.

Motor Selection and Application, by Charles C. Libby. 486 pages, $13.50. McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.

How to select and apply electric motors for specific industrial uses, based on load characteristics, service requirements, space limitations, duty cycle requirements, and safety. With a minimum of mathematics and theory, this book covers motor temperature rise, motor life, load torque characteristics, and motor enclosures for induction, synchronous, and dc motors.

Fixed and Variable Capacitors, by G. W. A. Dummer and Harold M. Nordenberg. 281 pages, $10.00. McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.

A working knowledge of capacitor design and construction to aid in selecting and applying fixed and variable capacitors in modern electronic equipment. Included are characteristics and applications of

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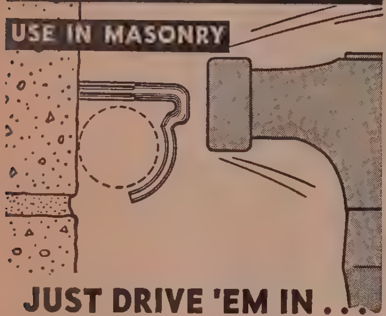

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ENUMERATING specific problems is Leonard Deutsch, Rubel Electric, Madelia, Minn., as he emphasizes post-session discussion with Fred Wiese, Wiese Electric, Lakefield, Minn., at recent Minnesota Electrical Association meeting in Minneapolis.

paper, mica, ceramic, glass, vitreous enamel, electrolytic, gas-filled, and other fixed capacitors plus full range of variable devices.

Electrical Maintenance and Repairs, by J. L. Watts; 324 pages; $3.25 postpaid. Cleaver-Hume Press Ltd., 31 Wright's Lane, London W8, Great Britain.

An excellent book for aiding maintenance staffs in keeping down operating costs, getting repair jobs done without interrupting production, and keeping wiring installations in order. The routine of fault location and plant repairs—from renewing sleeve bearings to diagnosing faults in mercury arc rectifiers—is set down systematically and summarized in tables. Sections on wiring are valuable to contractors; test questions for students will also be helpful reminders to the man on the job.

Estimator's Electrical Man-Hour Manual, by John S. Page and Jim G. Nation; 219 pages; $10.00. Gulf Publishing Co., P.O. Box 2608, Houston 1, Texas.

A standardized method and procedure of estimating electrical installation labor in manhours. Thousands of manhours are listed for conduit, boxes and fittings; service and feeder wiring; branch circuit items; lighting fixtures; panelboards and cabinets; safety switches; hangers and fasteners; underfloor raceway and busway; starters and motors; outside and underground construction; signal systems; and demolition and excavation. Tables are based on hundreds of time-and-motion studies showing an average productivity rate of 70%.

DATES AHEAD

Illuminating Engineering Society — Regional Conferences: **Canadian**, Nova Scotian Hotel, Halifax, N. S., June 13-14.

New York State Association of Electrical Contractors & Dealers—61st annual convention, Whiteface Inn, Lake Placid, N. Y., July 3-8.

National Association of Lighting Maintenance Contractors—National Conference, Milwaukee Inn, Milwaukee, Wis., August 22-24.

Illuminating Engineering Society—National Technical Conference, Penn-Sheraton Hotel, Pittsurgh, Pa., September 11-16.

International Association of Electrical Inspectors — Northwest Section, Sheraton-Portland Hotel, Portland, Ore., September 12-14; **Southwest Section**, Mapes Hotel, Reno, Nev., September 19-22; **Eastern Section**, Wentworth-By-The-Sea, Portsmouth, N. H., September 26-29; **Western Section**, Continental Hotel, Kansas City, Mo., October 3-5; **Canadian Section**, Toronto, Ont. Canada, October 8-9; **Southern Section**, Rice Hotel, Houston, Texts, October 17-19.

Pennsylvania Electric Assn.—53rd annual meeting, Penn-Sheraton, Pittsburgh, Pa., September 20-22.

NISA Chapter Meetings—**King Coal**, St. Louis, Mo., July 14; **North Central, Midwestern and Wisconsin**, Minneapolis, September 16-17; **Central Ohio**, Columbus, Ohio, September 18; **Southwestern**, Austin, Texas, September 22-24; **King Coal**, Evansville, Ind., October 13, and Mount Vernon, Ill., January 12, 1961.

American Welding Society—Fall Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., September 26-29.

International Association of Electrical Leagues—25th annual conference, Hotel President, Kansas City, Mo., October 5-7.

National Electronics Conference—Hotel Sherman, Chicago, Ill., October 10-12.

Florida Association of Electrical Contractors—Annual Convention and 8th Electrical Trade Show, Deauville Hotel, Miami Beach, Fla., October 12-15.

National Electrical Contractors Association—1960 annual convention, Las Vegas Convention Center, Las Vegas, Nev., October 23-27.

American Standard Assn.—11th National Conference on Standards, Sheraton-McAlpin Hotel, New York City, October 25-27.

National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 14-18.

Electrical & Home Appliance Show—Electrical Building, Balboa Park, San Diego, Calif., November 25-30.

Among the Manufacturers

Headquarters Announcements

Light & Power Utilities Corp., Memphis, Tenn., has purchased the **Locust Lighting Co.** of St. Louis, Mo.

U. S. Expansion Bolt Co., York, Pa., has announced the organization of **Western Expansion Bolt Co.,** San Francisco, Calif., as a subsidiary with Lionel W. Diaz as manager.

Bohn Aluminum & Brass Corp., Detroit, Mich.—Raymond C. McCullough, sales manager of extrusions and new products; P. G. Kayser, manager, B. W. Reid, sales manager, Frank Oreskovich, senior application engineer, and W. F. Foster, chief product engineer of air conditioning products, Heating and Cooling Coil Dept., Danville Div.

Square D. Co., Detroit, Mich.—Lawrence G. Maechtlen, president.

Marcus Transformer Co., Rahway, N. J.—Leonard J. Siegal, sales manager.

S. H. Couch Co., North Quincy, Mass.—Kenneth J. Ritchie, vice president.

Pitman Mfg. Co., Grandview, Mo.—Charles J. Cannon, vice president-sales.

Westinghouse Electric Corp., Pittsburgh, Pa. — Marshall K. Evans, vice president and director of management services; P. T. Lagrone, vice president, Southeastern region at Atlanta, Ga.; L. J. Owsley, regional marketing manager; N. C. Warner, regional agency and construction, aviation and transportation products manager; M. J. Donough, regional electric utility and industrial products manager.

William Brand-Rex Div., American Enka Corp., Concord, Mass.—Maurice Winger, Jr., general manager.

General Electric Co., Schenectady, N. Y.—Charles J. Graham, marketing manager, lightning arrester and cutout product section, Pittsfield, Mass.; William R. Smart, marketing manager, Distribution Transformer Dept., Pittsfield, Mass.; Raymond H. Rogers, manager of marketing, Specialty Transformer Dept., Fort Wayne, Ind.

Universal Mfg. Corp., Paterson, N. J.—Ben Mackoff, general sales manager.

Dukane Corp., St. Charles, Ill.—Alfred D. Masters, manager of commercial sound division.

GATHERING DATA on electric heating equipment and techniques at recent NEMA Electric House Heating Symposium in Chicago are enthusiastic contractors Ed Davis, Davis Electric Co., Weirton, W. Va.; and William Glandorf, Kent Electric, Inc., Kent, Ohio.

Sylvania Lighting Products, New York—T. C. Sargent, manager of commercial engineering.

Graybar Electric Co., Inc., New York—W. B. Whaley, treasurer.

Anaconda Wire & Cable Co., New York—James L. Vincent, secretary and treasurer.

Wheel Trueing Tool Co., Detroit, Mich.—Wendell E. Lloyd, treasurer.

Wagner Electric Corp., St. Louis, Mo.—Carl E. Widell, vice president of marketing.

Weston Instrument Div., Daystrom, Inc., Murray Hill, N. J.—John G. Morey, sales research and development coordinator.

Wolverine Tube, Div. of Calumet & Hecla, Inc., Allen Park, Mich.—L. A. Brewer, manager of tubing sales; R. C. Crowe, manager of product sales.

Keystone Manufacturing Co., Warren, Mich.—Robert L. Chandler, president.

Virden Lighting, Cleveland, Ohio — Donald Becker, assistant sales manager.

Clayton Mark & Co., Evanston, Ill.—Clarence Mark, Jr., executive vice president.

Mears Electric Controls, Inc. and Mears Electric Circuit Breakers, Inc., Portland, Ore.—W. K. Roots, chief engineer.

Appleton Electric Co., Chicago, Ill.—Donald R. MacLeod, director of industrial relations.

Royal Lighting Sales, Chicago, Ill.—Don Thomas, sales manager.

Telecontrol Div., Hancock Industries, Inc., Jackson, Mich.—Russel H. Meyer, sales manager.

Federal Pacific Electric Co.,

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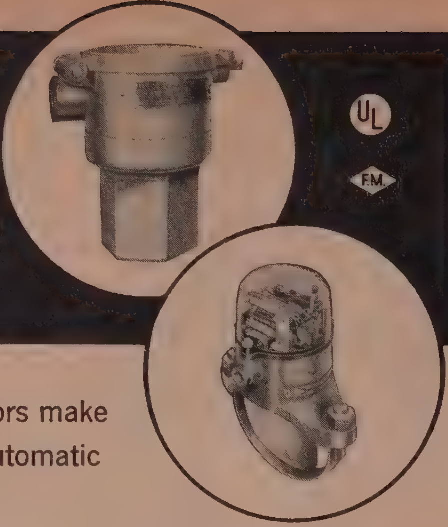

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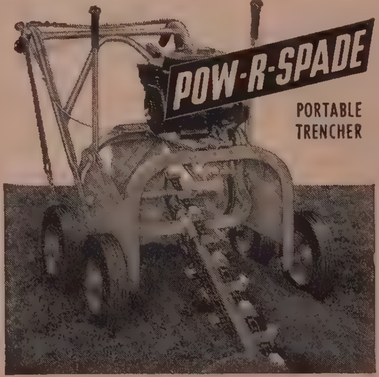

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U.S. Expansion Bolt Co., York, Pa.—Charles H. Schminke, general sales manager.

Sperti Faraday, Inc., Adrian, Mich.—E. N. Cellentani, signal systems sales manager.

Hitemp Wires, Inc., Westbury, N. Y.—William Blandy, manager of manufacturing.

International Resistance Co., Philadelphia, Pa.—Dr. Sidney J. Stein, vice president.

Silvray Lighting, Inc., New York —Russell A. Gilbert, manager, Consumer Products Div.

Luminator, Inc., Chicago, Ill.—Vernon H. Heins, vice president—design and engineering.

Revere Electric Mfg. Co., Niles, Ill.—Edward H. Reed, manager, Railroad and Industrial Lighting Sales Dept.

Joy Mfg. Co., Pittsburgh, Pa.—Robert E. Kinter, director of advertising and sales promotion.

Perfeclite Co., Cleveland, Ohio —Elio Rambaldi, vice president.

Owatonna Tool Co., Owatonna, Minn.—James E. Braas, industrial sales manager.

Aurora Pump Div., The New York Air Brake Co., Aurora, Ill.—Russell K. Annis, manager of engineering.

Markel Electric Products, Inc., Buffalo, N. Y.—Frederick E. Warner, assistant sales manager.

Regional Appointments

NEW ENGLAND

Wolverine Tube, Div. of Calumet & Hecla, Inc.—Richard H. Tucker, sales representative.

Electric Specialty Co.: Burlingame Associates, Mt. Vernon, N. Y., Northeast representative.

MIDDLE ATLANTIC

Clayton Mark & Co.: G & G Agency, Glenshaw, Pa., sales representative, western Pennsylvania area.

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Weston Instruments Div., Daystrom, Inc.: Joseph C. Fiege, manager, Albany district office; A. R. Walthers, Buffalo district manager; Edwin O. Brown, Philadelphia district manager.

Allis-Chalmers Mfg. Co.: Robert I. Carlson, manager of utility sales and Clare K. Tubbs, manager of industrial sales, Pittsburgh district.

I-T-E Circuit Breaker Co.: Jack A. Lueckert, manager, Syracuse district sales office.

Federal Pacific Electric Co.: Felix C. Karlson, eastern regional manager.

Paranite Wire and Cable Div., Essex Wire Corp.: Joseph Stuparitz, sales representative, Pittsburgh area.

National Electric Div., H. K. Porter Co., Inc.: John E. Tomes, manager, Philadelphia office; C. B. Jaggers, district manager, Pittsburgh.

Ledex, Inc.: Russell F. Clark Co., Inc., Pittsburgh, Pa., representative for Western Pennsylvania, West Virginia and bordering counties.

Bohn Aluminum & Brass Corp.: Robert L. Taylor, sales representative in Rochester-Buffalo-Syracuse.

General Electric Co.: R. L. Harden, sales representative, Eastern District, Silicone Products Dept.

International Resistance Co.: Jack Covert Associates, Pittsburgh, sales representative.

SOUTH ATLANTIC

LaSalle Steel Co.: Warren J. Trifiro, sales representative, southeastern territory.

Bishop Mfg. Co.: Andrew H. Baxter, Washington, D. C., sales representative.

Paine Co.: Ken H. Hill & Associates, Mt. Dora, Fla.; L. E. Porter, Jacksonville, Fla.; Jack Healy, Miami, Fla., sales representatives.

National Electric Div., H. K. Porter Co.: David J. Anderson, branch manager, Baltimore.

Ramset Fastening System, Olin Mathieson Chemical Corp.: Victor Christian, Jr., sales representative in Georgia.

Vickers, Inc., Electric Products Div.: J. W. Vaughan Co., Greenville, S. C., sales representative.

EAST CENTRAL

Vulcan Electric Co.: Handel-Davies Co., Cleveland; Oliver Sterling, Inc., Detroit; representatives.

Arvin Industries, Inc.: B. Allen Bryant, Atlanta, Ga., district sales manager, electric heat division.

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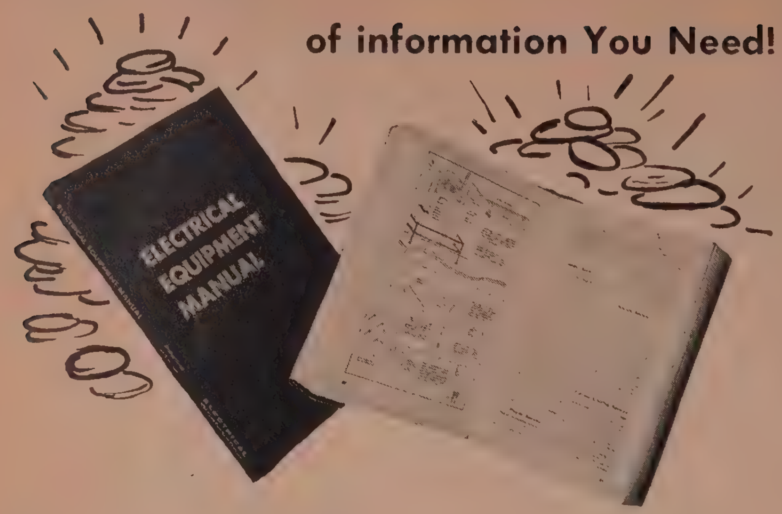

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Westinghouse Electric Corp.: Adolph Frankel, Chicago district sales manager, Lamp Div.

Cutler-Hammer Inc.: J. J. Witmer, manager, Peoria office.

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Wolverine Tube, Div. of Calumet & Hecla, Inc.: W. C. Glass, sales representative for Los Angeles district.

International Rectifier Corp.: William Searls, field sales representative, southern California.

Allis-Chalmers Mfg. Co.: W. C. Henderson, manager, utility sales; and A. W. Leighton, manager, industrial sales, Los Angeles district; C. E. Muller, manager, utility sales, San Francisco district.

I-T-E Circuit Breaker Co.: Ernest Thompson, manager, Phoenix district sales office.

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ELECTRIC HEATING IN APARTMENTS

[FROM PAGE 113]

heat to average about $10 a month. In a majority of cases this was a true statement, as annual bills rarely exceed $120 in the smaller apartment units.

People who have lived regularly in apartments generally had heat furnished and had no idea of the seasonal fluctuations of heating requirements. As a consequence, those who moved in during mid-summer and had very nominal bills for two or three months were quite shocked with their first bill of the winter heating season. Complaints to the apartment owner as well as the utility were the natural result.

Some utilities have adopted a monthly budget billing procedure, and bills are prorated as equally as possible through a year with one particular month as an equalizing month. To date we have not found this necessary in Seattle.

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In summing up this growth of electric heating of apartment houses, I would like to try to answer a question that is frequently asked —how do we at Seattle City Light sell electric heat to apartment buildings?

Actually, I believe that we in the utility business can take but minor credit for the rapid increase in the acceptance of electric heating of apartment buildings. While we do strive to assist every customer in getting the greatest possible benefit from the electric energy we supply to him, it is my belief that the ease and simplicity of accurate control of electric energy, its unsurpassed cleanliness, and the ease in which it can be delivered and measured separately to each apartment rather than to a central heating plant are the factors which have brought about this demand for apartment house electric heating.

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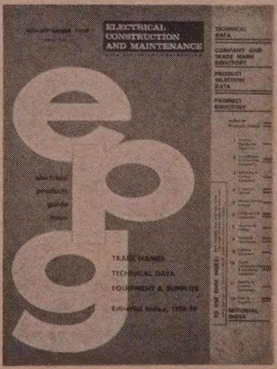

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